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Note on an occurrence of bertrandite and beryl at the South Crofty mine, Cornwall.[1]

(With Plate XXV.)

By James Phemister, M.A., D.Sc.

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[Read March 7, 1940.]

MONG a series of specimens collected by Mr. H. G. Dines from the South Crofty mine, Illogan, one was found to contain bertrandite beryl. The specimen was obtained from the back of the 290-fathom , east of Robinson's shaft, in the no. 1 lode, which hades north and his position is 3 feet 10 inches wide. The location of the specimen about 9 inches from the granite footwall. In hand-specimen the is a normal stanniferous veinstone composed of massive quartz ed grey-green by disseminated chlorite and tourmaline and traversed tripes of blackish 'peach' and white vein quartz which run parallel he lode walls. Microscopically it is composed essentially of quartz, rite, and tourmaline, with subordinate orthoclase, fluorspar, and iterite, accessory apatite, and local bertrandite and beryl. In its ure there is evidence of an early formation of stanniferous chlorite-maline peach with quartz-fluorspar gangue, which was subsequently tured and, later, more or less completely healed by an accession of tz, some redistribution of the earlier minerals having taken place he same time. The place of bertrandite and beryl in this general me is discussed below (p. 576).

ertrandite.—This mineral is most abundant in a narrow vein-like egate of chlorite (daphnite) which with tourmaline forms one of dark stripes in the veinstone. With chlorite, and sometimes quartz

[1] Communicated by permission of the Director, Geological Survey and Museum.

also, it occurs both as pseudomorphs after idiomorphic beryl (pl. xx figs. 2 and 3) and as shapeless clots more or less dispersed by l quartz of the veinstone. Its distribution, even in the dispersed mode occurrence, is very restricted, since it has been found within a wid of only 6 mm. of rock across the striping and seems also to disappear a direction parallel to the stripe.

When embedded in chlorite, it habitually forms anhedral grains whi often are grouped into composite grains up to 0·4 mm. across. Agai quartz good crystal faces are developed and a few good prisms co pletely surrounded by quartz have been observed, the largest bei 0·2 mm. in length. The bertrandite often encloses small flakes of chlor and the two minerals clearly belong to one period of formation. It recognized in thin section as an unusual mineral by its moderate fractive index combined with medium birefringence, biaxial negat character, and large optic axial angle. These characters, together w at least two good cleavages and trisector twinning with twinning a parallel to the acute bisectrix, complete the qualitative diagnosis bertrandite. The mineral was present in insufficient quantity for cognition in test crushed samples and the refractive indices were the fore determined on an uncovered thin section, the values being α 1·5 β 1·604 or 1·605, γ 1·614. By use of the Berek compensator the b fringence was determined as $\gamma - \alpha$ 0·025. Measurements of the optic a angle by universal stage methods yielded values of 2V ranging fr 71° to 76° for different grains. Three values of 2V, 71°, 72°, and 7 were obtained from a trisector twin which showed the emergence of acute bisectrix from each sector (fig. 1). The measurements on twinned crystal showed, as should be true for bertrandite, that twinning axis coincides with the α-axis of optical symmetry and t the angle between corresponding β and γ axes in the twins is close to In the zone of the α-axis cleavages corresponding to (010) and (and faces corresponding to (011) and (031), on the assumption that the crystallographic a-axis, were observed in various grains.

Optical constants and such crystallographic relations as could determined thus affirm the identity of the mineral as bertrandite. values of the refractive indices are practically the same as those obtai by T. Vogt,[1] and somewhat higher than those given by H. L. Bowm

[1] T. Vogt, Bertrandit von Iveland im südlichen Norwegen. Zeits. Kryst. 1911, vol. 50, pp. 6–13.

[2] H. L. Bowman, On the occurrence of bertrandite at the Cheesewring qu near Liskeard, Cornwall. Min. Mag., 1911, vol. 16, pp. 47–50.

ertrandite from Iveland, Norway, and from the Cheesewring quarry, wall, respectively.

rtrandite, a hydrated silicate of beryllium, is a rare mineral, but is d at several localities[1] in Cornwall in addition to the Cheesewring ry. At all of these, as at all other localities reported hitherto, it rs in granite or pegmatite as small crystals on joint-planes or in ies, and the occurrence under description is the first, so far as the r has been able to discover, in which the containing rock is not ite, and in which the mineral has been recognized only under the oscope.

eryl occurs in the same rock as the bertrandite described above, and e more abundant and more evenly distributed where it is present, so is restricted to the neighbourhood of the dark stripe which con- s the bertrandite. All the beryl occurs embedded in quartz and has riety of habit. It may form single idiomorphic prisms, fresh except a little chloritization along cracks and, more rarely, formation of randite in cracks (pl. xxv, figs. 4 and 6). These prisms reach 0·5 mm. ss. More frequently, it is present as slender prisms which are some- s hollow, as swarms of needles (fig. 5), and as groups of beryl- erial which is optically continuous and has arranged itself in a tal manner so that idiomorphic, but interrupted, crystal outlines me visible. The habit of the slender prisms greatly resembles that urmaline, which like the beryl frequently sends out acicular pro- ations parallel to the *c*-axis. The swarms of needles are often tly parallel and sometimes define a rectangular area suggestive of arlier mineral. The swarms and the skeletal growths are enclosed uartz but reach through the quartz grains without displacement at grain boundaries. The beryl is identified by its shape, uniaxial tive character, birefringence estimated as 0·006 from the inter- ce colour, and by its moderate refractive index which, from the t relief of the mineral against quartz, must be about 1·57.

nother and earlier generation of beryl is represented by idiomorphic domorphs filled with chlorite, chlorite and bertrandite, or chlorite quartz with or without bertrandite; orthoclase is sometimes present perfect prisms enclosed in the quartz. The sections of the pseudo- hs show rectangular and hexagonal outlines, the hexagons corre- ding in shape to regular basal and slightly elongated longitudinal ons. Rarely an almost circular outline suggestive of a twelve-sided

. Russell, Notes on the occurrence of bertrandite at some new localities in vall. Min. Mag., 1913, vol. 17, pp. 15–21.

section has been observed. Where quartz forms part of the pseudo morph it is continuous with the surrounding quartz and appears t represent a late replacement of the pseudomorphous minerals. Needle of the new generation of beryl, orientated parallel to the earlier, some times appear in those pseudomorphs which are largely replaced b quartz. Under the dispersing action of late quartz-bearing solutions the idiomorphic outline of the pseudomorphs degenerates and it is no possible to say whether some shapeless clots of chlorite and bertrandit represent the locus of earlier beryl crystals. It is, however, probable tha some aggregations of chlorite and bertrandite have been deposited fro solution, the beryllium presumably having been derived from beryl an transported over a very limited distance.

The appearance of chlorite in pseudomorphs after beryl is not common the aluminous mineral arising in the transformation being usuall muscovite. The chlorite present at South Crofty mine is the iron-ric species daphnite with uniaxial negative character and ω 1·660. Ber trandite is associated with chlorite in specimens from Wheal Metal Breage. (A. Russell, loc. cit., p. 18.)

Paragenesis of the minerals and source of the beryllium.—Beryl is a extremely rare mineral in Cornwall, and hitherto Cornish bertrandit has appeared to be independent of beryl. In all other regions the deriva tion of bertrandite from beryl is evident and, though Machatschki thinks the alteration is due to the action of descending alkaline solutions it is generally[2] held that the transformation from the alumino-silicate beryl, to the hydrated silicate, bertrandite, takes place during a late hydrothermal phase of igneous activity. The South Crofty occurrenc is consonant with this view. The stanniferous veinstones themselve represent a long-continued, interrupted hydrothermal stage of th igneous activity which earlier caused the irruption of the granites o Cornwall and Devon, and the transformation of beryl to chlorite an bertrandite occurred long before the close of the hydrothermal action The exact date of the transformation is, however, difficult to ascertain Chlorite forms an essential constituent of the cassiterite-bearing peac and there is no means of distinguishing it from the chlorite replacin

[1] F. Machatschki, Mineralogische Notizen. Der Beryll von Pisek und sein Zersetzungsprodukte. Zeits. Krist., 1926, vol. 63, p. 462. [M.A. 3–310.]

[2] F. H. Pough, Bertrandite and epistilbite from Bedford, New York. Amer Min., 1936, vol. 21, p. 265 [M.A. 6–362]; P. Ramdohr, Bertrandit von Klein Spitzkopje, Südwestafrika. Zentralbl. Min., Abt. A, 1936, p. 257 [M.A. 6–431] W. Brandes, Das natürliche Vorkommen des Berylliums. Zeits. Prakt. Geol., 1933 vol. 41, p. 35.

yl, except where the outline of the latter is preserved. Bertrandite evertheless most abundant in chlorite which has a vein-like relation he peach, and it is only rarely that bertrandite-chlorite aggregates w any sign of mechanical fracture or distortion. Therefore it is bable that the transformation of beryl to bertrandite and chlorite k place after the brecciation of the tourmaline-peach. It seems most ly that the original beryl was present in the peach and one example pseudomorph possibly of beryl embedded in tourmaline aggregate been observed. The pseudomorph has a hexagonal outline and is d by quartz, chlorite, and tourmaline; it contains neither bertrandite secondary beryl.

he regeneration of beryl took place at the time of accession of quartz, ch healed the fractured veinstone and redistributed some of the rmaline. Recrystallized tourmaline is thus enclosed with acicular yl in quartz (pl. xxv, fig. 5). The same type of beryl appears within udomorphs from which chlorite and bertrandite have been largely placed by quartz. Development of secondary beryl has been reported n other regions, for example by Vogt (loc. cit., p. 7) from Iveland by Penfield[1] from Mt. Antero, but from the latter locality the new yl is described as residual by solution of the main beryl crystal.

he proximate source of the beryllium contained in the existing yllium minerals is thus an early beryl, but the origin of this beryl ncertain. There are two possibilities: (1) Since the lodes at South fty mine are in granite and probably originated along a line of cture, it is possible that the beryl is relic from fractured granitic terial. (2) The beryl may have been introduced by the early neralizing solutions which deposited tourmaline, cassiterite, fluor, and rtz in the vein. In support of the first hypothesis is the apparently y local occurrence of the beryllium minerals. Moreover, though no ucture definitely indicative of the presence of an early granitic breccia been observed, the veinstone contains much orthoclase as small ins optically continuous over considerable areas, suggesting that hoclase, presumably mechanically derived from granite, was an y component of the vein filling. The fixity of the beryllium minerals hin or very close to the pseudomorphs of the original beryl suggests that beryllium was not easily transportable by the later hydro-rmal solutions. In support of the second alternative is the actual sence of the beryllium minerals as a constituent of veinstone in close

[1] S. L. Penfield, Some observations on the beryllium minerals from Mt. Antero rado. Amer. Journ. Sci., 1890, vol. 40, pp. 489–490.

association with tourmaline and cassiterite. The apparent rarity of this association may be due to the ease with which beryl is replaced by chlorite under the conditions prevailing in the Cornish lodes. The transformation having now been demonstrated, further work should prove whether it has operated extensively or whether beryl or its pseudomorphs must still be regarded as a rare and perhaps fortuitous component of the veinstone.

The writer wishes to acknowledge much helpful discussion with Dr. W. F. P. McLintock and the valued assistance of Miss E. M. Guppy in searching the literature.

Explanation of Plate XXV.

Bertrandite and beryl from South Crofty mine, Illogan, Cornwall.

(The numbers refer to the Rock Slide Collection of the Geological Survey and Museum.)

Fig. 1. E. 18218. Trisector twin of bertrandite. Nicols crossed. ×360.

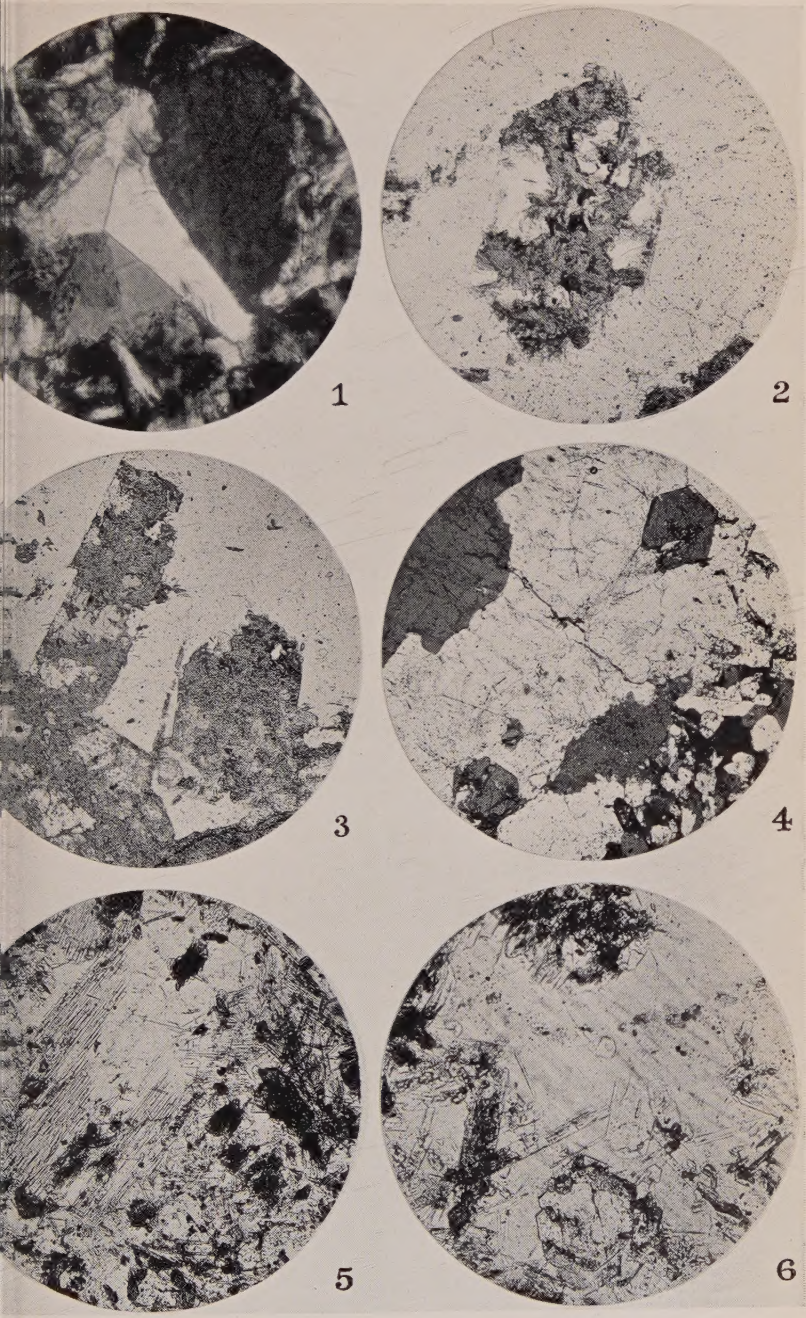
Fig. 2. E. 18218α. Pseudomorph of beryl in chlorite and bertrandite which are replaced, on left, by quartz continuous with the surrounding quartz. Ordinary light. ×47.

Fig. 3. E. 18218α. Pseudomorphs of beryl in chlorite and bertrandite, surrounded by quartz. Ordinary light. ×30.

Fig. 4. E. 18218g. Hexagonal crystals of beryl: at top right, fresh with chalybite in crack; bottom left, fresh with chlorite and bertrandite in cracks. Nicols crossed. ×24.

Fig. 5. E. 18218g. Needles of beryl associated with slender prisms and aggregates of tourmaline in quartz. Ordinary light, closely diaphragmed. ×53.

Fig. 6. E. 18218α. Hexagonal and prismatic, acicularly terminated, sections of beryl, showing variable replacement by chlorite. Ordinary light, diaphragmed. ×70.



J. Phemister: Bertrandite and beryl from Cornwall.

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New refractometers employing diamond and other minerals.

By B. W. Anderson, B.Sc., F.C.S., C. J. Payne, B.Sc.
Laboratory of the Diamond, Pearl, and Precious Stone Trade Section of the London Chamber of Commerce,

and J. Pike, A.R.C.S.
of Messrs. Rayner & Keeler, Ltd., Instrument Makers, London.

[Read June 8, 1939.]

DIRECT-READING refractometers depend upon observation of the boundary between transmission and total internal reflection, when at surface of a specimen is placed in optical contact with the flat face of the isotropic medium employed in the instrument. This ium is usually a heavy lead glass in the form of a hemisphere or m. The upper limit to the range of indices which can be measured is rmined by two factors: the refractive index of the medium employed he instrument, and the refractive index of the liquid used to make cal contact between the two surfaces.

iquids of high refractive index are essential to such instruments, and e reference to them may be conveniently made at this stage. Various liquids, mixtures, and melts of high refractivity have been proposed time to time, chiefly as immersion media. These include:

	n_D.
ylene iodide saturated with sulphur, further saturated with tetra-do-ethylene[1]	1·81
yl-di-iodoarsine[2]	1·85
ylene iodide, sulphur, and iodides[3]	1·868
rine and iodides[3]	1·68–2·10
phorus, sulphur, and methylene iodide[4]	2·06
ium bromide and selenium[1]	2·06

first-mentioned liquid seems quite stable, has no objectionable perties, and no appreciable chemical action on the surface of the l high-refractive index glass. All the remainder, amongst other

B. W. Anderson and C. J. Payne, Nature, London, 1934, vol. 133, p. 66. . 5–503.]
B. W. Anderson and C. Payne, loc. cit., and ibid., 1936, vol. 138, p. 168.
H. E. Merwin, Journ. Washington Acad. Sci., 1913, vol. 3, p. 35.
C. D. West, Amer. Min., 1936, vol. 21, p. 245. [M.A. 6–460.]

disadvantages, have a damaging effect on the glass surface of refract meters and are therefore undesirable for use with these instrumen Thus, though in some models of the Tully refractometer[1] the sca extended to 1·9, the upper regions were in practice not available witho some risk of damaging the glass surface with a reactive liquid.

It may be useful to mention briefly some of the other disadvantag of these liquids for the information of those who intend to use the Phenyl-di-iodoarsine has a blistering action on the skin. The iodid in Merwin's liquid make a very dark mixture, and tend to crystalli out as a precipitate. Piperine and iodide melts need careful preparati and solidify at room-temperatures. West's phosphorus melt must kept under water and handled with care owing to the spontaneo inflammability of the yellow phosphorus present; and finally, seleniu bromide is so deep a red as to be practically opaque, is unpleasant handle, and does not make good optical contacts unless diluted with little of the 1·81 methylene iodide mixture. In short, it may be said th all these liquids having $n_D > 1{\cdot}81$ are only suitable for laboratory u

Failing the discovery of a harmless and very refractive liquid, furth progress could only be made by substituting for the glass used in t hemisphere some transparent isotropic mineral of even higher refracti index which would be less liable to chemical attack by the spec liquids.

Zinc-blende suggested itself as an obvious possibility and experimen were carried out six or seven years ago, when attempts were made construct a Tully refractometer with a hemisphere of blende. A piece blende at once sufficiently large and clear for the purpose was hard find, and the experiment was not successful. It was, however, appare that there was reasonable expectation of being able to make up sm pieces of the required degree of clarity, and the problem of constructi an instrument to utilize small pieces was undertaken. If successful, was realized that the use of diamond as the refracting mineral might a practical possibility.

Hitherto gemmological refractometers have almost invariably e ployed a hemisphere or segment of highly refracting glass, and it w apparent that departure from this convention was almost essential i diamond was to be used on account of cutting difficulties. Prisms blocks of glass are well-known in such instruments as the Abbe a Pulfrich refractometers, which are too elaborate for routine use w gemstones, sacrificing the advantage of rotation of the testing surfa

[1] B. J. Tully, Min. Mag., 1927, vol. 21, p. 324.

ue first experimental model of the new type utilized a prism of zinc-
de and, by using West's liquid, satisfactory readings to just over
were obtainable for the first time. This original instrument was
for obtaining a range of values for zircons of all kinds.[1] When a
prism was used in place of the blende, the design proved so satis-
ry and inexpensive to make that it was marketed as the Rayner
ctometer.

Diamond Refractometer.

wing to the generosity of the Diamond Corporation it was now
ble to utilize diamond as the material for the prism. Though its

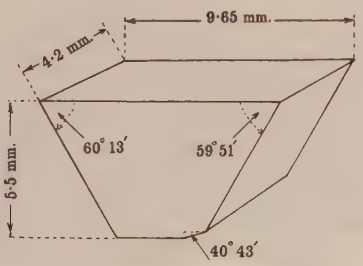

Fig. 1. Diamond prism of refractometer.

tive index is slightly higher than that of blende (2·42 against 2·37)
a: advantages over the latter lie not in this fact, but in its greater
al purity and in its great hardness, which enables it to take a high
h which will not suffer abrasion from any of the specimens tested.
e diamond given us for experimental use in the refractometer had
llowing properties. Original weight 6·632 carats, density $d_4^{15°}$ 3·519.
into prism, weight 2·505 cts. Quality 'silver cape'. Refractive
es (determined with prism of angle 40° 43′):

... ...	6708	5893	5461	5350	4358	4227
... ...	2·4104	2·4190	2·4257	2·4275	2·4504	2·4554

Dispersion: 2·4558 − 2·4104 = 0·0454.

e cutting of the stone was entrusted to Mr. Kaner, who was asked
t a truncated prism (fig. 1) with angles as nearly 60° as possible.
actual angles were found to be 60° 13′ and 59° 51′—remarkably
ate work when one considers that only the crudest form of gonio-
ical aid was employed as a check during cutting.

. W. Anderson and C. J. Payne, Gemmologist, London, December 1937.
7–131.]

In its present form (fig. 2), the diamond refractometer enab readings to be taken from 1·52 to 2·03. The scale for this range is th times as long as for the early blende instrument and therefore beyo the scope of a fixed eyepiece. The eyepiece is made to slide over t

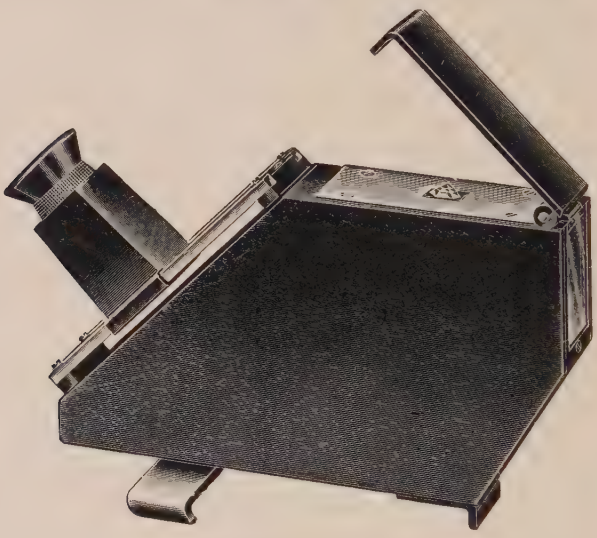

Fig. 2. Diamond refractometer.

scale on parallel rails and can be moved to a position quite clear of t scale. The approximate position of the shadow-edge is first not observing the scale at a normal reading distance without the eyepie the eyepiece is then moved into position for the scale to be observ The open scale enables estimation of indices to the third decimal pl to be made with comparative ease.

The diamond refractometer having proved a satisfactory pattern, t same model can equally well be made with a blende prism, covering t same range of indices.

One can only hope that a stable liquid having a refractive index over 2·0 and no unpleasant properties will eventually be discovered use with the diamond and blende refractometers.

Spinel Refractometer.

By the substitution of a prism of colourless synthetic spinel for t prism of high-refractive index glass usually employed, an instrum having certain great advantages over the normal refractometer

ned, albeit with a restricted range. The synthetic spinel ($d_4^{15°}$ 3·625) for the prisms gave the following values for refractive index by the mum deviation method, the prism angle being 60° 20¾′.

...	...	6870	6708	5893	5350	4308	4227
...	...	1·7222	1·7225	1·7266	1·7304	1·7417	1·7431

e dispersion for the B—G interval is 0·0195, and for C—F approxily 0·0110, which is only a little higher than that for the species h fall within the range of the instrument. The dispersion of the a dense flint' glasses commonly used in refractometers is enor-

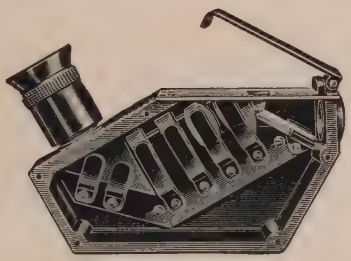

Fig. 3. Spinel refractometer.

ly greater. For two samples of Chance-Parsons glass, for instance, akers supplied the following figures: n_D 1·8012, dispersion (C—F) 3; n_D 1·9203, C—F, 0·0436.

ring these figures in mind, it will be understood that the critical for light passing from the spinel prism into the specimen tested s hardly at all for different wave-lengths, with the result that a , uncoloured shadow-edge is obtained when using ordinary white while with the normal dense glass prism the shadow-edge consists fringe of spectrum colours, and monochromatic light must be yed where accurate readings are required.

e short range covered by the spinel refractometer enables a more scale to be used, with consequent increase in the accuracy of the gs. The spinel surface is, of course, practically unabraded by any e gem minerals tested. For all readings below 1·65 monobromohalene is an ideal contact liquid, on account of its oily nonle nature.

Colloidal gold as a colouring principle in minerals.

By J. Newton Friend, D.Sc., and John P. Allchin.

Central Technical College, Birmingham.

[Read March 7, 1940.]

MANY attempts have been made to discover the causes of various colours displayed by minerals. If we except fluoresce and allied phenomena, the different theories advanced may in general grouped under one or other of the following classes:

(1) Colour may be due to an intrinsic property of atoms, ions, molecules. Examples are copper atoms, chromate ions, and ferric ox molecules.

(2) Colour is sometimes attributed to structural causes. The b tints of certain halites have been explained in this way; but a fr suggestion is made in this communication.

(3) A pigmentary impurity may cause the observed colour. T colour of the ruby is believed to be caused by the presence of a chromic oxide.[1] The blue tint of a Yorkshire aragonite is shown la to be due to a copper salt.

(4) Some minerals show plays of colours due to interference and grating effects. Labradorite and opal are cases in point. Into t group also fall minerals like bornite which become iridescent fr tarnish.

(5) Finally, some minerals owe their colour to the presence of fore substances in colloid form. This differs from ordinary pigmentation that the colour of the impurity itself bears no relation whatever to t of the mineral, because the colour is due to scattered light, not reflec light. The impurity may, when by itself, be actually colourless. Parti of colloid dimensions are too small to reflect incident light; they can o scatter it; hence for any one particular colloidal substance its own deg of dispersion will determine the wave-length or colour of the scatte light, whilst its concentration will fix the actual depth or intensity that colour.

[1] C. W. Stillwell, Journ. Physical Chem., 1926, vol. 30, p. 1441; also vide in

o very important features of this theory are:

It is not necessary to assume the presence of a different chemical sion with each of the colours shown by a mineral in these circum- es, as must generally be the case when the colour is due to pig- ary particles. Theoretically almost any colour may result from a colloidal inclusion by mere adjustment of the particle size.

The quantity of material in colloid form required to produce a ed colour is invariably much less than in the case of a pigment. ubstance may thus easily escape identification. Thus, for example, ng. of gold present as chloride in 50 g. of water—equivalent to rts per million—are imperceptible with the unaided eye. On re- on to colloidal gold, however, a clear rose colour develops, if tannic s employed. Under favourable conditions 1 to 4 p.p.m. of colloidal may produce a detectable tint in an otherwise colourless mineral.

e present research originated in an attempt to ascertain whether or ny members of the rare-earths, hitherto seldom found in the British although relatively abundant in certain localities in Scandinavia, be detected in British minerals containing the alkaline earths. In rst instance the minerals were spectrographed using a Hilger quartz rometer, and we happened to notice that lines due to gold were nt in some coloured celestines, notably those from the Yate area, estershire. It occurred to us that their colours and perhaps those f specimens from other localities might be due, in part at any rate, s gold being present in the colloid state.[1] A search through the ture showed that, although this particular aspect of the subject ot received much attention, there were indications that it was careful study.

their research on the Malvern crystalline rocks, Brammall and e[2] invariably found silver and usually traces of gold. Although the rs did not discuss the possibility that these metals might influence olour of the rocks, they did mention that the higher values of these nts were associated with the red granites and with various types of d' rock to which the red granites had been contributory. One gly reddened granite contained 4·6 p.p.m. (72 grains per ton) of gold 5 p.p.m. (42·4 dwt. per ton) of silver.

ice[3] has mentioned the association of gold with coloured quartz in

N. Friend and J. P. Allchin, Nature, London, 1939, vol. 144, p. 633. [M.A.]

Brammall and D. L. Dowie, Min. Mag., 1936, vol. 24, p. 260.

L. Bruce, Trans. Roy. Soc. Canada, 1934, ser. 3, vol. 28, sect. 4, p. 7. 6–264.] In the paper numerous references are quoted to coloured quartz.

Canada and suggests that the colour may not be due to any particu foreign substance but to the state in which the foreigner may occ The spectrograph of the Dunkin blue quartz, reproduced in Bruc paper, shows the gold line 2676. This, of course, does not prove that colour was caused by colloidal gold. Professor Bruce has informed of us that he could not guarantee that the quartz, when spectrograph was entirely free from specks of mechanically included gold. Nevert less, the coincidence is interesting.

Of all the elements gold is one of the most easy to convert from dissolved into the colloid state. The action, even, of hot water alone n suffice to produce blue colloidal gold from aurous chloride.[1] Owing to chemical inertness, once the metal has been reduced from its compou it is very permanent. If, therefore, traces of gold derivatives beco disseminated throughout a mineral, any agent that can effect th reduction to the metal, whether by chemical or purely physical mea may also effect a very permanent tinting of that mineral. Various ti of red, purple, and blue are the most frequent colours shown by colloi gold, and Long[2] has given reasons for supposing that the blue form n be the most stable of all.

Gold is known to be widely diffused in nature in small quantities, our experiments appear to indicate that it may be even more wid distributed than has hitherto been believed. It is not one of the sensit elements, spectrographically, and may easily escape detection; the lo limit is given as some 10 p.p.m. by ordinary spectrographic metho The 'Glimmschicht' procedure, developed by Goldschmidt and his workers, is claimed to be some fifty times more sensitive[3] but does appear to have come as yet into general use amongst mineralogists. have frequently succeeded in detecting traces of gold in minerals chemical tests although none of the characteristic lines appeared in spectrograph.

It was decided, therefore, to examine as many specimens of celes as possible from different localities in an endeavour to ascertain if connexion existed between the colour and the gold content. Ot minerals were then added to the list. They were first spectrograp and the presence of suspected inclusions checked by chemical metho quantitative microchemical analyses were also made.

[1] L. Vanino and L. Rössler, Zeits. Chem. Ind. Kolloide, 1910, vol. 6, p. 289
[2] S. H. Long, Proc. Univ. Durham Phil. Soc., 1913, vol. 5, p. 113.
[3] L. W. Strock, Spectrum analysis, 1936. [M.A. 6–291.]

Methods of Analysis.

some of our analytical methods, though based on recognized pro-e, were somewhat different in detail and have been found to yield stent results, it may be useful to place them on record.

ld was estimated both gravimetrically and volumetrically. In the er method some 5 g. of the finely powdered mineral (other than tes) were digested three times with aqua regia which extracted the leaving a colourless residue. The gold was reduced with phenyl-azine and citric acid, collected on a sintered glass filter, and weighed microbalance.[1]

e volumetric method, proving more sensitive than the foregoing, sed in the later determinations. The solution containing the gold, ued as above, was taken to dryness, re-dissolved in three drops of ntrated nitric and six of hydrochloric acids. Excess chlorine and syl chloride were removed in a current of air and the resulting solu-diluted with water to 50 c.c. in a Nessler tube. 0·5 c.c. of a 5 % us solution of ammonium hydrogen fluoride was added with 1 c.c. 0·1 % solution of *o*-dianisidine in 0·1 % aqueous hydrochloric acid. shaking and standing, the solution was titrated with hydroquinone, ly acidified with acid, until the red colour developed by the auric acid with the *o*-dianisidine was discharged as the gold ed reduction to metal.[2] With siliceous minerals it was necessary o fuse with potassium hydrogen sulphate, leach with water, and the residue to dryness with acid to render the silica insoluble. The was then extracted with aqua regia as before.

nganese was estimated colorimetrically by the usual persulphate od, the manganese being oxidized to permanganate.

ckel was estimated by the dimethylglyoxime method; a separate on of the mineral was fused with potassium hydrogen sulphate and nickel estimated colorimetrically in the usual way.

tanium. After fusion of the mineral with potassium hydrogen ate and leaching, the insoluble portion was taken up in hydrochloric and estimated colorimetrically after addition of hydrogen peroxide.

nc, *Copper*, and *Iron* were estimated in the same portion of

[1] Using M. E. Pozzi Escot's method of reduction, Ann. Chim. Anal., 1907, 12, p. 90.

[2] This method is based on that recommended for testing urine in the 'B.D.H. of reagents for delicate analysis', 7th edit., 1939, p. 64. The solution of quinone we used contained 0·0335 g. per litre, 1 c.c.≡0·04 mg. gold. (From . Pollard, Analyst, 1937, vol. 62, p. 597.)

aragonite(no. 23).[1] After dissolving the mineral in dilute hydrochlo acid and oxidizing any iron with a drop of nitric acid, the soluti was brought to about 4·9 *p*H with ammonium acetate and hydroxi controlled with the British Drug Houses universal indicator.

The solution so obtained was shaken with successive small amou of 0·1 % solution of 'dithizone' (diphenyl thiocarbazone) in chlorofor each extract being separately washed with ammonium acetate soluti of 4·9 *p*H. The zinc and copper yield complex derivatives with t dithizone which are soluble in the chloroform, the iron remaining the aqueous portion.

Shaking the chloroform solution with dilute hydrochloric acid extra the zinc complex, and the acid solution is taken to dryness and orga matter is removed by oxidation with hydrogen peroxide and perchlo acid in the usual way. Glacial acetic acid is added, together with a lit hydrochloric acid, KI, HNH_4F_2, and excess potassium ferricyani solution, using starch as indicator. The blue colour thus developed discharged by titration with *N*/500 thiosulphate in a microburette.

The chloroform contains the copper complex and is taken to dryne organic matter removed by warming with concentrated nitric a sulphuric acids, and the residue taken up in water. Aliquot portions rendered alkaline with ammonia and a few c.c. of 0·1 % aqueous sodi diethyldithiocarbamate[2] added whereby a brown colour develops. T brown colouring matter is extracted in four successive extractions w carbon tetrachloride and its intensity measured with a Bolton a Williams colorimeter using light of λ 570 $\mu\mu$.

To the original aqueous solution containing the iron, 2 c.c. of 20 citric acid solution are added, the whole made alkaline and 0·2 c.c. 50 % thioglycollic acid introduced. The intensity of the colour veloped is measured with the colorimeter using light of λ 530 $\mu\mu$.

Strontium was estimated in the aragonite (no. 23) by dissolution nitric acid, extracting the residue with anhydrous acetone,[3] in wh calcium nitrate is soluble, filtering through a Gooch crucible, and dry the residue of strontium nitrate at 105° C.

Consideration of the Results.

The results obtained are summarized in the accompanying table, a may now be discussed in the same order.

[1] The details of this method were worked out by Mr. E. A. Hardy, to whom take this opportunity of expressing our indebtedness.

[2] See B.D.H. Book of reagents, p. 103.

[3] P. E. Williams and H. T. Briscoe, Chem. News, 1932, vol. 145, p. 177.

old appears to be even more widely distributed in minute amounts inerals and rocks than has hitherto been recognized.

e would emphasize that many factors may be involved in producing colours of minerals. The mere fact that gold may be proved to be ent does not of necessity also prove that this element is the cause of colour or even contributory to it. On the other hand, its possible ence should not be ignored.

lestine. The blue colour of certain celestines, to which, indeed, the ral owes its name (Latin caelum, sky), is often attributed to traces ivianite[1]—a mineral possessing deep pigmentary power. When, ever, our specimens (nos. 1 to 3) from Yate were gently heated, the crystals lost their colour and assumed a very pale pink tint. The rless and reddish-brown crystals remained virtually unaffected. As nite turns neither pink nor colourless on gentle heating it seems obable that the colours of our specimens could be due to this cause. 1915 Doelter[2] suggested that the colouring agent of celestine might iloidal sulphur produced by reduction of some of the sulphate. This has the advantage of offering an explanation for the observed tions in colour; but evidence that colloidal sulphur is actually nt in the celestine is lacking. Whilst agreeing with Doelter that the r may quite well be due to some impurity in colloid form, we re to suggest that it may be due in part or in its entirety to colloidal All our coloured celestines contained sufficient of this element to the observed colours. Ultramicroscopic examination of both blue red specimens from Yate showed the presence of colloid particles. ecimens nos. 1 to 3 from Yate the depth of colour rose with the gold ent. As the iron content was greatest in the colourless crystals) and as no iron could be detected in the blue celestine from Gir- (no. 9) it would seem that iron must be absolved from any com- in the matter. Titanium likewise appears to be ruled out.

e three colourless specimens, nos. 1, 11, and 12, contained no gold ugh iron was present. The white Kingston mineral was the richest n. Opaque rust-brown patches occurred in the Renfrew specimen; were entirely different in appearance from the translucent reddish- n colour of the Yate celestine (no. 3) and were probably due to iron.

psum. Through the kindness of Mr. Arthur Russell we have been o examine a specimen of reddish-brown gypsum (no. 13) from the

ana, System of mineralogy, 6th edit., 1892, p. 906; H. A. Miers, Mineralogy, p. 524.

Doelter, Die Farben der Mineralien. Braunschweig, 1915. [M.A. 1–227.]

same locality (Yate) as our analogously coloured celestine (no. 3). Th intensity of the colour varied greatly in different parts of the gypsu which was, in general, less translucent than the celestine. A little go was present, but the iron content was high, especially in the dark portions. It is not clear why the gold should have shown so marked preference for the celestine.

The two specimens of gypsum from Blue Anchor (nos. 14 *a* and *b*) we similar in appearance to that from Yate; but only one of them contain gold in varying amounts. The specimen from Tyburn (no. 15) had a pa opaque reddish-brown tint, and contained only a trace of gold. It can from red Triassic clay from a well bore-hole at a depth of 200 feet fro the surface. There were other layers of gypsum at various depths, son white, others green, the latter lying in greenish clay. The colo appeared to be governed by the state of oxidation of the iron.

The *calcareous stalactite* (nos. 16 *a* and *b*) was a portion of one Mr. W. Pengelly's original specimens taken from Kent's Caver Torquay, about the middle of last century. It was given to one of by Mr. W. J. Else, curator of the Hastings Museum, Worcester, ma years ago, and is of special interest because sporadic gold has been fou in the neighbourhood of the cavern, notably at Daddy Hole and Hop Nose.[1] In cross-section the stalactite was oval and measured 7 a 5 cm. across. The outer portion was very pale yellowish pink a surrounded a pinkish disk, some 3·5 cm. in diameter. The specim readily broke along the edges of this disk suggesting that an inter had elapsed after the stalactite had first attained the dimensions of t inner portion before it began to grow again. Only the merest trace gold could be detected in either the outer or the inner portion—of t order of 1 p.p.m. Iron was present, but no manganese.

It is known that the clays, &c., from which alkali salts have crystalliz in nature are usually richer in noble metals than the alkali salts the selves.[2] It was of interest to ascertain if this likewise applied to o calcite. Analysis of two portions of clayey earth (nos. 17 *a* and from the cavern showed them to contain much more gold than t calcite; their iron content was, as expected, enormously greater. piece of stalagmite (no. 17 *c*) from the cave floor was relatively rich gold but was contaminated with a considerable amount of clay.

[1] W. T. Gordon, Nature, London, 1922, vol. 109, p. 583; A. Russell, Min. Ma 1929, vol. 22, p. 159.

[2] See, for example, J. Goubeau and L. Birckenbach, Zeits. Anorg. Chem., 19 vol. 236, p. 37.

We were a little surprised at the absence of gold in the Madoc *baryte* 21) and *wollastonite* (no. 22), both of which showed a pale transnt blue cast, not unlike the anhydrite (no. 26) mentioned below, and gestive of colloidal matter.

he mauve and pale green tints of the Ontario *calcites* (nos. 18 and 19) the more ruddy colours of the Frontenac baryte (no. 20) and ite (no. 24) were not due to gold.

pecial interest is attached to the pale green *aragonite* from Lunehead e, Yorkshire. It occurred in a lead-baryte vein in which Mr. Russell noticed minute crystals of chalcopyrite associated with the baryte. ng on a hint from Mr. Russell we made a more detailed analysis than al. The results are given in the table. The colour is due to some per salt, presumably the carbonate. The presence of 4·7 % strontium onate suggests identity with mossottite, recorded from the Lias at falco in Tuscany;[1] this latter mineral had nearly 7 % of strontium onate; its density was 2·884 as against 2·889 for our specimen.

Ruby. In 1798 Vauquelin, the discoverer of chromium, detected that ment in the spinel-ruby; in 1837 Gaudin[2] observed that addition of a ll amount of chromic oxide to alumina and fusion in an oxyhydrogen e yielded the colour of the natural ruby; since then the colours both the spinel and true ruby have been attributed to chromium. nerous analyses have confirmed the presence of chromium, but it ot clear that gold has been definitely searched for. Vogel[3] found ural and artificial rubies to exhibit the same absorption curves. Leary, Royer, and Papish[4] observed that the depth of colour of ural rubies is apparently proportional to their iron and chromium tents; also that the amount of these oxides in the more deeply ured specimens coincides with that which must be added to synthetic parations to yield the same colour.

This would appear to be conclusive; nevertheless, in view of the sical use of gold in the production of 'ruby' glass, it seemed of erest to make a direct search for gold in the natural stone. Examina- n of a specimen (no. 25) of typical ruby colour failed to detect either ctroscopically or chemically any trace of gold. Chromium was sent. The stone had been purchased in 1920 from a mineralogist and s undoubtedly a natural one.

Dana, System of mineralogy, 6th edit., 1892, p. 283.

M. A. Gaudin, Compt. Rend. Acad. Sci. Paris, 1837, vol. 4, p. 999.

P. Vogel, Neues Jahrb. Min., Abt. A, 1934, Beil.-Bd. 68, p. 401. [M.A. 7–129.]

W. J. O'Leary, G. L. Royer, and J. Papish, Science, New York, 1934, vol. 80, 12.

Anhydrite frequently possesses a blue cast and its translucent, colloi character has been recognized. The blue colour of a Japanese anhydrit was attributed by Kinoshita[1] to colloidal calcium sulphate. Specime no. 26 from Cropwell Bishop, Nottinghamshire, was found to contai sufficient gold to impart the observed pale blue cast, although othe equally blue specimens have been found to contain no gold.

Rock-salt is frequently found coloured in nature, the more usua colours being violet, blue, and pink, although a light yellow has also bee observed.[2] The blue halite of Stassfurt has, in particular, received muc attention since Sir Humphrey Davy observed it in 1818, and variou suggestions have been offered to account for the colour. Siedentopf suggested that it was due to colloidal sodium, and prepared a syntheti blue halite by heating the colourless salt in sodium vapour. Cornu supported this theory and it was regarded as satisfactory until Spezia observed that the synthetic and natural blue halites did not posses identical properties; the former, for example, on dissolution in wate gave a more alkaline solution than the colourless salt, whereas th natural blue and colourless halites were equally alkaline.

More recently, Phipps and Brode[6] have prepared blue, pink, and gree halites by Siedentopf's method; using a modified hydrogen electrod method of great delicacy, they found that all of these coloured specimen were distinctly alkaline. On the other hand, six colourless specimens o halite from Navarre (Michigan), two from Stassfurt, and five natura blue ones, also from Stassfurt, showed zero alkalinity. Further, spectro photometric study of the natural and artificial blue halites showe marked differences in their absorption curves. The authors, therefore conclude that colloidal sodium cannot be the cause of the colour in th natural halite. They regard the colour as due to abnormality in con straint upon electrons which belong properly to the halite lattice.

Doelter[7] has for many years continued to regard the colour as due t foreign inclusions other than alkali metals, whether colloidal or other

[1] K. Kinoshita, Journ. Geol. Soc. Tokyo, 1925, vol. 32, p. 9. [M.A. 3–118.]

[2] K. Przibram, Nature, London, 1936, vol. 137, p. 107.

[3] H. Siedentopf, Physikal. Zeits., 1905, vol. 6, p. 855. Also R. Zsigmondy, Zu Erkenntnis der Kolloide, 1905, p. 58.

[4] F. Cornu, Neues Jahrb. Min., 1908, vol. 2, p. 22. Also T. Svedberg, Colloid chemistry, 1924, p. 67.

[5] G. Spezia, Centralbl. Min., 1909, p. 398.

[6] T. E. Phipps and W. R. Brode, Journ. Physical Chem., 1926, vol. 30, p. 507.

[7] C. Doelter, Monatsh. Chem., 1929, vol. 52, p. 241. [M.A. 4–252.] Reference are given to his earlier work.

He favours the idea of mixtures of iron and manganese, although nur and organic substances are not ruled out. We have found traces on to be present (see table) in our specimens, but no manganese.

ennard, Howell, and Yaeckel,[1] however, have recently decided ist any pigmental theory. They examined spectroscopically a men of colourless Stassfurt halite containing a distinct blue zone. difference could be detected in chemical composition between the ired and colourless parts. In addition to small amounts of calcium, s of lithium, potassium, aluminium, silicon, and titanium were nt in both, together with still smaller amounts of magnesium, tium, and barium. They mention that titanium, strontium, and m had not been recorded before. They associate themselves with who regard the colour as structural.[2]

parently the presence of traces of gold has not hitherto been ally looked for. Mention has already been made of the fact that y easily escape detection. It occurred to us, therefore, that con- bly the coloured halites contain this element. It appeared possible se it is known that sea-water frequently contains gold. Caldwell,[3] an improved method, finds it may amount to 0·2 mg. per metric equivalent to some 6·6 mg. per metric ton of halite, or roughly rt in 150 million of sea-water. If during evaporation this gold e concentrated locally it might easily, upon reduction to the l state, give rise to coloured streaks in the resulting rock-salt. her, Przibram[4] has already noted a similarity between the blue of anhydrite and rock-salt, and we have shown gold to be present e-tinted anhydrite from Cropwell Bishop (no. 26). We accordingly ined several coloured halites and, as shown in the table, gold was nt in all of them. Of all those quantitatively examined the blue men from Stassfurt (no. 27) contained the maximum amount of and was also the most deeply tinted.[5] A minute black inclusion 29) in the pink translucent halite (no. 28) appeared to be the source

1. G. Kennard, D. H. Howell, and M. P. Yaeckel, Amer. Min., 1937, vol. 22, [M.A. **6**–503.]

Particularly K. Przibram, Sitzungsber. Akad. Wiss. Wien, Abt. II a, 1934, 43, p. 489; 1924, vol. 132, p. 262; &c. [M.A. **3**–116, **6**–263.] F. C. Guthrie, re, London, 1929, vol. 123, p. 130; Phipps and Brode, loc. cit.

V. E. Caldwell, Ind. Eng. Chem. Anal., 1937, vol. 9, p. 530. [M.A. **7**–435.]

K. Przibram, British Chemical Abstracts, 1938, p. 482; from Kali, 1936, 0, p. 61. [M.A. **7**–526.]

. N. Friend and J. P. Allchin, Nature, London, 1940, vol. 145, p. 266. [M.A. 7.]

of waves of pink in its vicinity. It was extracted and analysed togethe with some of the more deeply tinted halite surrounding it. As is seen i the table, both the gold and the iron contents were higher than in th rest of the crystal.

The effect of gentle heat on the blue halite was very similar to tha on the celestine. The blue colour disappeared, yielding successively violet, lilac, and very pale pink; ultimately the salt became colourless This is in harmony with numerous other observations recorded by earlie workers.

Specimen no. 30 from Cheshire was less translucent than the tw others and more earthy; its colour was no doubt influenced by its iro content. The colours of the two translucent salts (nos. 27 and 28) however, could quite well have been caused by colloidal gold. The pin and blue specimens from Hallstatt and Wieliczka respectively containe gold, but the amounts could not be ascertained as the specimens wer too small.

GOLD CONTENTS OF VARIOUS MINERALS.

No.	Mineral.	Colour.	Locality.	Source.	Parts per million.
1	Celestine	White	Yate, Glos.	B. Topley, Oldbury	Au nil Fe 19
2	,,	Pale blue, translucent	,,	,,	Au 49 Fe 4
3	,,	Red-brown, translucent	,,	,,	Au 85 Fe 4 Ti nil
4	,,	Blue, translucent	Coast of North Berwick	R. Scottish Museum, Edinburgh	Au 34 Fe 11 Ti nil
5	,,	,,	,,	,,	Rich in Ba Au 30 Fe 10 Ti nil
6	,,	,,	,,	J. Whitecross N. Berwick	Au 55 Fe 5
7	,,	Extremely pale pink	Seacliff quarry E. of North Berwick	,,	Au 5 Fe 25 Mn trace Ti nil
8	,,	Blue, translucent	Lanark Co., Ontario	Govt. of Ontario, 1922	Au 9 Fe 30 Ti nil
9	,,	,,	Girgenti, Sicily	British Museum	Au 5 Fe nil Ti nil
10	,,	,,	Sicily	National Mus. Wales	Au 5 Fe 52

Mineral.	Colour.	Locality.	Source.	Parts per million.
Celestine	White	Kingston, Ontario	Govt. of Ontario, 1922	Au nil Fe 53
,,	White, with rust-brown streaks	Renfrew Co., Ontario	,,	Au nil Fe 13
Gypsum	Red-brown	Yate, Glos.	A. Russell	Au 6 Fe 5
,,	Red-brown, deeper than 13a	,,	,,	Au 9 Fe 230
,,	Red-brown, similar to 13a	Blue Anchor, Somerset	British Museum	Au 0 Fe 130
,,	,,	,,	Museum, Birmingham	Au 45, 95 Fe 55, 49
,,	Very pale red-brown	Tyburn, Birmingham	—	Au 1 Fe 99
Calcitic stalactite	Very pale yellow-pink (outer shell)	Kent's Cavern, Torquay	Museum, Worcester	Au trace Fe 25 Mn nil
,,	Very pale yellow-pink (inner portion)	,,	,,	Au trace Fe 33 Mn nil
Clay earth	Red	,,	—	Au 19 Fe 3·19%
,,	,,	,,	—	Au 26 Fe 3·05%
Floor stalagmite	,,	,,	—	Au 21 Fe 4·32%
Calcite	Very pale mauve	Lanark Co., Ontario	Govt. of Ontario, 1922	Au nil Fe 332
,,	Pale green	Rideau Lake, Ontario	,,	Au nil Fe 237
Baryte	Red-brown	Frontenac Co., Ontario	,,	Au nil Fe 114
,,	Pale blue, translucent cast locally, otherwise white	Madoc, Ontario	,,	Au nil Fe 130
Wollastonite	Very faint blue cast	Lewis Co., New York	Foote Mineral Co.	Au nil Fe 40
Aragonite	Pale green	Lunehead mine, Yorks.	A. Russell	Au nil Ni nil Cu 237 Zn 1240 Sr 4·7%
Stilbite	Deep red-brown	Unknown	British Museum	Au nil Fe 2600

No.	Mineral.	Colour.	Locality.	Source.	Parts per million.
25	Ruby	Ruby-red	Unknown	Purchased in 1920	Au nil Cr present
26	Anhydrite	Very pale-blue cast	Cropwell Bishop, Notts.	A. Russell	Au 4 Fe 4
27	Rock-salt	Indigo-blue, translucent. Colour zones sporadic	Stassfurt, Prussia	Gregory, Bottley & Co.	Au 23 Fe 32 Mn nil
28	„	Pale pink translucent	Unknown	—	Au 7 Fe 6 Mn nil
29	„	Pale pink, translucent but with small black inclusion	„	—	Au 12 Fe 8 Mn nil
30	„	Pale pink to brown	Meadow mine, Cheshire	Gregory, Bottley & Co.	Au 9 Fe 41 Mn nil
31	„	Blue	Wieliczka, Poland	British Museum	Au presen
32	„	Pink	Hallstatt, Austria	„	„

Summary.

1. Gold appears to be even more widely distributed in minute amount in minerals and rocks than has hitherto been generally recognized.

2. It is emphasized that many factors may be involved in producin the colours of minerals. The mere presence of gold is not in itself proo that it is responsible for the colour.

3. Nevertheless, reasons are given for the suggestion that the tran lucent blue tints of the specimens of celestine, anhydrite, and halit could be caused by colloidal gold.

4. The translucent pink and reddish-brown tints of the halite an celestine specimens examined may likewise be connected with their gol contents.

5. Gold has been found in several other minerals, but not in a natur ruby.

6. Aragonite from Lunehead mine, Yorkshire, was tinted with copp and bore a close resemblance to mossottite from Tuscany.

The authors desire to express their deep indebtedness to the variou institutions and persons mentioned in the table who have so generousl supplied them with the mineral specimens described.

Studies of mineral sulpho-salts: II. Jamesonite from Cornwall and Bolivia.

(With Plates XXVI and XXVII.)

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[Read June 6, 1940.]

JAMESONITE is described in Dana (1892, p. 122) as a soft, brittle, steel-grey to lead-grey mineral forming acicular orthorhombic crystals, $a:b = $ '0·915:1' (in error for 0·8195:1), with perfect basal cleavage; composition, $2PbS.Sb_2S_3$; principal occurrence, Cornwall. Jamesonite is taken as the type member of a group that includes cosalite, described in the first of these studies (1939), dufrenoysite, and other minerals of analogous composition.

Earlier and also later descriptions of jamesonite depart in various respects from this characterization. The symmetry of the needle-like crystals, previously assumed to be orthorhombic in the absence of terminal faces, was found to be monoclinic by Slavík (1914) whose material, however, was not definitely identified as jamesonite. Stevanović (1922), on the other hand, gave orthorhombic elements without measurements. More recently Hiller (1938) derived a monoclinic structural cell from powder and rotation photographs.

There is also disagreement on the question of the composition of jamesonite. The typical Cornish material with prominent cross cleavage, described under 'Compact Grey Antimony' by Jameson (1820, p. 391) and named jamesonite by Haidinger (1825, p. 451), was analysed by H. Rose (1833) who obtained the formula $3PbS.2Sb_2S_3$. Subsequently Rose (1839) analysed a feather-ore from Wolfsberg in the Harz deriving the formula $2PbS.Sb_2S_3$; this mineral was classed as plumosite by Haidinger (1845). Plumosite was united with jamesonite by Rammelsberg (1860) and thus jamesonite acquired the erroneous formula $2PbS.Sb_2S_3$ generally adopted in the later texts. The original formula of jamesonite reappeared as $(Pb,Fe)S.2Sb_2S_3$, given by Eakins (1888) to a supposed new mineral named domingite by Groth (1889) and warrenite by Eakins (1890). Spencer (1899, 1907a) exposed the foregoing confusion, emphasizing the fact that jamesonite needles are brittle owing to the cross cleavage,

while the flexible fibres of most feather-ores may belong to one another of several other species. From analyses by Prior, on Bolivi jamesonite, Spencer (1907b) derived a new formula $7(Pb\frac{4}{5}Fe\frac{1}{5})S.4Sb_2$ which recognized iron as an essential constituent. On felted fibres nam plumosite, from Felsőbánya, Loczka (1908) obtained another formu $4PbS.FeS.3Sb_2S_3$; Schaller (1911) showed that this formula agrees w with representative analyses of jamesonite collected by Spencer (1907

In addition to the above uncertainties regarding the fundamen properties of jamesonite there is the fact that jamesonite is notoriou difficult to distinguish from boulangerite in ore specimens. A study typical jamesonite and other materials named jamesonite, by X-r methods and observations on polished sections, thus promised to le to a better definition and easier identification of the species.

Materials and acknowledgments.

Of the numerous specimens labelled jamesonite or resembling jam sonite which were examined in the course of the present work, a lar proportion proved to be boulangerite; this was true of all the availa Canadian examples. The following is a list of the remaining specime which gave the X-ray powder pattern of jamesonite, the names on t labels being retained:

1. Jamesonite (Harvard Mineralogical Museum, 11501), Cornwall, Englan columnar aggregates with cross cleavage.

2. Jamesonite (Dept. of Mineralogy, University of Toronto, A/471), Endelli Cornwall; columnar aggregate with cross cleavage.

3. Jamesonite (Dept. Min., University of Toronto, A/1469), Cornwall; colum aggregate with well-developed cross cleavage.

4. Jamesonite (Royal Ontario Museum of Mineralogy, M/14506), Itos mine, n San Felipe de Oruro, Bolivia; columnar aggregates with cross cleavage, and mas of fibres.

5. Heteromorphite (plumosite) (Royal Ontario Museum of Mineralogy, M/916 Itos mine, Oruro, Bolivia; masses of fibres.

6. Jamesonite (Ahlfeld Collection, 552, Harvard Mineralogical Museum), F venir mine, Huanuni, Bolivia; columnar aggregates with cross cleavage.

7. Jamesonite (Royal Ontario Museum of Mineralogy, M/19680), Carmine mi Araca, Bolivia; columnar aggregates with cross cleavage and fibres in quartz.

8. Jamesonite (British Museum of Natural History, 80934, 83057–8), Cerro Ubina, Huanchaca, Potosi, Bolivia; single needles representing material descri by Spencer (1907b) and analysed by Prior.

9. Zinckenite (Royal Ontario Museum of Mineralogy, M/19694), Santa C mine, Poopo, Bolivia; needles and radiating fibres with cross cleavage in quartz

These materials were kindly made available for study by Profes Charles Palache (Harvard University, Cambridge, Mass.), Profes A. L. Parsons (Toronto), and Mr. F. A. Bannister (British Museu

Hon). Professor M. A. Peacock has variously assisted me in the se of the work and in the preparation of this paper.

Physical properties.

ne values for the specific gravity of jamesonite, collected in Spencer 7b), range from 5·478 to 5·719. Since good values of specific gravity useful for identification and essential in determining cell contents, further measurements were made on the available material, using Berman balance. One measurement, probably the best, was made the pyknometer. The new measurements are given below together the previous values:—

Cornwall	5·56	Material 1
	5·57, 5·58, 5·61	Material 2
	5·56, 5·60	Material 3
Bolivia	5·63	Material 4 (pyknometer)
	5·519, 5·546	Spencer (1907b)
Spain	5·616	Schaffgotsch (1836)
	5·467	Genth (1879)
Harz	5·478–5·49	(fibres) Zincken and
	5·693–5·719	(coarse powder) Rammelsberg (1849)
Argentina	5·54	Stelzner (1873)
Calculated	5·67	From X-ray data

nsidering the difficulty in obtaining a good value for the specific ity of a fibrous mineral the above data are fairly consistent. The est measured values for Cornwall, Bolivia, and Spain are but little of the calculated value and are probably nearest the truth.

lished sections of jamesonite, with vertical illumination and crossed s, are shown in plate XXVI. Fig. 1 shows a columnar aggregate Cornwall; fig. 2 gives parts of two single crystals from Bolivia. sections show the basal cleavage, which is good rather than perfect, also longitudinal cleavage with undetermined indices. Spencer 7b) found no confirmation of the early noted cleavages (010) and . Shannon (1925), on the other hand, again noted the pinakoidal age (010) and a prismatic cleavage with the angle 62° 51′; this sponds to the angle (120): $(\bar{1}20) = 62° 29'$ in our notation.

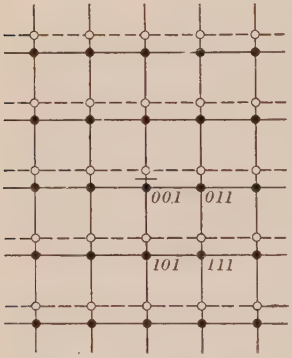
ordinary reflected light polished sections of jamesonite are galena- e; crossed nicols reveal strong anisotropism, the polarization colours g tan, brown, light blue, dark blue. Standard etch-reactions: HNO_3

gives an iridescent stain which rubs grey and iridescent; the fumes giv a brown tarnish. HCl fumes give a slight brown tarnish. KCN negative $FeCl_3$ negative. KOH gives a faint iridescent stain which rubs of $HgCl_2$ negative. Short (1934) gives the hardness B+ (Talmage scale).

Jamesonite may be distinguished from boulangerite by the transvers cleavage and by a microchemical test for iron, which gives a stron positive reaction with jamesonite but not with boulangerite. Th reaction to KOH is also distinctive, being positive for jamesonit negative for boulangerite.

Structural crystallography.

The identity of the foregoing materials having been established b means of X-ray powder photographs, which gave the pattern discusse later, the structural lattice and spac group were determined from single-cryst X-ray photographs on a needle measurin $1{\cdot}5 \times 0{\cdot}02$–$0{\cdot}03$ mm. from material 4. O the reflecting goniometer the crystal gav a train of weak signals from the zone the needle axis, taken as [001]; terminal faces were noted. The phot graphs were made with unfiltered copp radiation using an equi-inclination Wei senberg X-ray goniometer with radi $360/4\pi$ mm.



TEXT-FIG. 1. Jamesonite. Reciprocal lattice projection of the layer (*hk*1) showing twinning on (100).

The rotation photographs about [00 (pl. XXVII, fig. 1) showed the zero, firs and second layer-lines, and no inte mediate layer-lines on strongly expos films. Using both the α and the β lines from two photographs t period in the needle axis, $c = 4{\cdot}03 \pm 0{\cdot}01$ Å., was obtained.

The Weissenberg photograph of the zero layer (*hk*0) (pl. XXVII, fig. showed orthorhombic symmetry, indicating an orthorhombic or a mon clinic lattice, with eighteen orders of (*h*00) and twenty orders of (0*k*0 including the orders extinguished by the space group symmetry a the structure. These diffractions gave the spacings $d_{100} = 15{\cdot}67 \pm 0{\cdot}05$ Å $d_{010} = 19{\cdot}01 \pm 0{\cdot}05$ Å.

The Weissenberg photograph of the first layer (*hk*1) (pl. XXVII, fig. was found on projection (text-fig. 1) to represent a monoclinic latti

$\beta = 91° 48' \pm 30'$, twinned by reflection in (100). The lattice ents are thus:

$$a = 15{\cdot}68 \pm 0{\cdot}05,\ b = 19{\cdot}01 \pm 0{\cdot}05,\ c = 4{\cdot}03 \pm 0{\cdot}01\ \text{Å}.;$$
$$\beta = 91° 48' \pm 30'.$$

ae systematically missing spectra conform to the conditions ($h0l$) rnt only with h even, ($0k0$) present only with k even, which are hcteristic for only one space-group, $C_{2h}^5 = P2_1/a$.

Geometrical crystallography.

n terminated needles doubtfully identified as jamesonite, from ·jovic, west Bohemia, Slavík (1914) derived the monoclinic elements:

$$a : b : c = 0{\cdot}8316 : 1 : 0{\cdot}4260;\ \beta = 91° 24\tfrac{1}{4}',$$

a series of sixteen well-established forms, eleven of which are sented by terminal planes. Slavík's elements are related to the tural elements by the transformations:

Slavík to Berry: (100)/(010)/(00½)
Berry to Slavík: (100)/(010)/(002).

vík's notation is thus transformed to the structural notation by y halving his c-axis, giving the comparison:

$a : b : c = 0{\cdot}8316 : 1 : 0{\cdot}2130;\ \beta = 91° 24\tfrac{1}{4}'$ (Slavík, goniometric)
$0{\cdot}8247 : 1 : 0{\cdot}2120;\ \beta = 91° 48'$ (Berry, X-ray).

e consequent halving of the l-indices in Slavík's form symbols leads systematic simplification.

support his choice of elements Slavík gives a table[1] of 36 measured calculated interfacial angles. These have been re-computed with nce to the structural elements. The new calculated angles are on hole closer to the measured angles than Slavík's calculated angles, ing that the structural elements represent the measured crystals more closely than the geometrical elements. An abbreviated table, ing the angles observed only once by Slavík, illustrates this point; is table the structural notation is adopted. The new calculated angle, $m(110) : m'(1\bar{1}0) = 79° 00'$, is close to Haidinger's angle, = 78° 40' (Cornwall), and practically identical with Spencer's , $mm' = 79° 01'$ (Bolivia, 23 measurements).

this table there are some discrepancies. Slavík gives $ed = *35° 17'$ as a mental angle, and later $ed = 35° 08'$ (meas.), $35° 04'$ (calc.). Also, for 29° 57' (meas.), 29° 44¼' (calc.), read 39° 57' (meas.), 39° 44¼' (calc.), as y noted by Niggli (1924, p. 508).

TABLE I. Jamesonite: measured and calculated interfacial angles.

		Slavík (meas.)	Slavík (calc.)	Berry (calc.)
e (021)	: e' (0$\bar{2}$1)	*46°08′	—	45°56′
	: d ($\bar{2}$01)	*35 17	—	35 18
d (20$\bar{1}$)	: m (110)	*70 28	—	70 23½
c (001)	: m (110)	88 36	88°55½′	88 37
m(110)	: m'(1$\bar{1}$0)	79 07	79 28½	79 00
	: b (010)	50 25	50 15¾	50 30
	: l (210)	16 44	16 10	17 06
	: n (120)	19 18	19 15¼	19 15½
	: e (021)	74 04	74 15	74 18½
e (021)	: f (011)	11 05	11 02¾	11 00
	: b (010)	67 01	66 56	67 02
	: d ($\bar{2}$01)	35 08	35 04	35 18
	: s ($\bar{2}$31)	25 29	25 09½	25 36
d ($\bar{2}$01)	: b (010)	90 11	90 00	90 00
	: o ($\bar{2}$21)	20 51	20 47¾	20 54
	: q ($\bar{2}$11)	10 56	10 45	10 48½
	: s ($\bar{2}$31)	29 47	29 40¼	29 48

The identity of Slavík's crystals is thus placed beyond question, a
we can give a formal angle-table for the established forms of the spec
(table II). In this table the angles have the significance given in Palac
(1934, fig. 1), our ϕ_2 ρ_2 being equivalent to Palache's ϕ'' ρ''.

TABLE II. Jamesonite: angle-table. Monoclinic; prismatic—2/m.

$a : b : c = 0{\cdot}8247 : 1 : 0{\cdot}2120$; $\beta = 91°48'$

$p_0 : q_0 : r_0 = 1{\cdot}2131 : 1 : 4{\cdot}719$; $\mu = 88°12'$

$p_0' = 0{\cdot}2572$, $q_0' = 0{\cdot}2120$, $x_0' = 0{\cdot}0314$.

Forms.	ϕ.	ρ.	ϕ_2.	ρ_2 = B.	C.	A.
c (001)	90°00′	1°48′	88°12′	90°00′	0°00′	88°12
b (010)	0 00	90 00	0 00	0 00	90 00	90 00
a (100)	90 00	90 00	0 00	90 00	88 12	0 00
n (120)	31 14½	90 00	0 00	31 14½	89 04	58 48
m(110)	50 30	90 00	0 00	50 30	88 37	39 30
l (210)	67 36	90 00	0 00	67 36	88 20	22 24
f (011)	8 25½	12 06	88 12	78 02	11 57½	88 14
e (021)	4 14	23 02	88 12	67 02	22 58	88 23
d ($\bar{2}$01)	−90 00	25 47	115 47	90 00	27 14	115 47
t (111)	53 42	19 42	73 54	78 29	18 17	74 14
r ($\bar{1}$11)	−46 48½	17 12½	102 43½	78 19	18 33½	102 27
v ($\bar{1}$31)	−19 33	34 01	102 43½	58 11	34 39	100 47
z ($\bar{3}$52)	−33 46	32 31	109 31	63 27½	33 33	107 23
q ($\bar{2}$11)	−66 18	27 48½	115 47	79 11½	29 28	115 17
o ($\bar{2}$21)	−48 43½	32 43½	115 47	69 06	34 06	113 58
s ($\bar{2}$31)	−37 13	38 36½	115 47	60 12	39 43½	112 16

Uncertain: g(031).

Powder photographs.

n view of the usefulness of X-ray powder photographs for the purpose dentification, several of the powder photographs of jamesonite are oduced on plate XXVII, figs. 4–6. The photographs were made with oer radiation (nickel filter), in a camera with radius $360/4\pi$ mm. le III gives for each powder ring the glancing angle corrected for kness of sample ($\theta_{Cu.}$), the estimated intensity (I_P), the corresponding ar spacing ($d_{meas.}$), the most probable indices (hkl), the planar ings corresponding to these indices ($d_{calc.}$), and the intensity of the esponding spot if it lay in the range of the Weissenberg photographs . With large cell dimensions the indexing of a powder photograph omes increasingly uncertain as the spacings diminish. However, the lation serves its main purpose in showing that most of the powder s near the middle of the photograph correspond to strong observed le crystal diffractions.

iller (1938) took powder photographs with iron radiation on jame- e from fourteen localities, including Cornwall. Using these photo- hs and the period $b = 2 \times 4{\cdot}27$ Å., obtained from a rotation about needle axis, in combination with Slavík's axial angle β, Hiller ined a cell with $a = 16{\cdot}16$, $b = 8{\cdot}60$, $c = 13{\cdot}75$ Å., containing $_2Sb_2S_5$]. Since these data bear no resemblance to ours, except that r's b is about double our c, it was of interest to see whether Hiller's der data corresponded with ours. The last two columns in table III Hiller's glancing angles computed for copper radiation ($\theta_{Cu.}$), and recorded intensities ($I_{P(Fe)}$). The far-reaching agreement shows that er was indeed working with jamesonite. But in attempting to find dimensions of a large monoclinic cell mainly from powder photo- hs Hiller stretched the powder method far beyond its inherent tations.

TABLE III. Jamesonite: X-ray powder spectrum.

						Hiller	
$\theta_{Cu.}$	$I_{P.}$	$d_{meas.}$	(hkl).	$d_{calc.}$	$I_{W.}$	$\theta_{Cu.}$	$I_{P(Fe)}$.
11·0	s	4·03	(400)	3·92	vvs	10·9	vvw
11·8	s	3·76	(021)	3·71	vs	11·8	vvw
13·0	vvs	3·42	(250)	3·42	vvs	12·9	vs
13·9	vvw	3·20	(060)	3·17	m	—	—
			(510)	3·09	vvs		
14·3	s	3·11	(231)	3·09	vvs	14·3	m
			(350)	3·07	vvs		
15·1	w	2·95	(260)	2·92	vs	14·9	vw

TABLE III (*continued*).

$\theta_{Cu.}$	$I_{P.}$	$d_{meas.}$	(*hkl*).	$d_{calc.}$	$I_{W.}$	Hiller $\theta_{Cu.}$	Hiller $I_{P(Fe).}$
15·9	s	2·81	(331)	2·81	vs	15·8	s
16·4	vs	2·72	(411)	2·74	vvs	16·4	s
			(360)	2·71	vvs		
18·9	vw	2·37	($\bar{2}$61)	2·39	s	—	—
			(080)	2·38	s		
			(521)	2·36	s		
			(261)	2·36	s		
19·4	s	2·31	(640)	2·29	vvs	19·5	s
20·0	s	2·25	(560)	2·23	s	20·1	s
			(470)	2·23	s		
			(171)	2·22	vs		
20·7	vvw	2·17	(380)	2·16	m	20·9	vvw
			(271)	2·15	vs		
—	—	—	—	—	—	21·5	vw
22·0	vs	2·05	(371)	2·05	s	22·0	vs
			(081)	2·05	vvs		
22·1	vs	2·04	($\bar{1}$81)	2·03	vs	22·4	vs
			(740)	2·02	vvs		
23·0	vw	1·967	(641)	1·986	vs	—	—
			($\bar{4}$71)	1·967	vs		
			(800)	1·959	vs		
23·8	m	1·905	(0.10.0)	1·901	vvs	23·9	m
24·1	w	1·882	(651)	1·878	s	24·3	vvw
24·9	s	1·826	(760)	1·828	vvs	24·9	s
25·9	vvw	1·760	(412)	1·761	—	26·0	vvw
26·6	m	1·717	(671)	1·720	s	26·6	m
			(920)	1·713	s		
28·4	vvw	1·616	($\bar{5}$91)	1·617	m	28·7	vvw
29·1	vvw	1·581	(0.12.0)	1·584	m	—	—
			(1.12.0)	1·576	m		
30·2	m	1·528	(552)	1·529	—	30·5	m
—	—	—	—	—	—	31·6	vvw
31·9	vw	1·455	($\bar{2}$.12.1)	1·452	vs	32·0	m
—	—	—	—	—	—	32·3	vvw
32·9	vw	1·415	—	—	—	33·0	m
—	—	—	—	—	—	33·8	vvw
34·4	m	1·361	—	—	—	34·4	vvw
34·8	vw	1·347	—	—	—	35·1	vvw
—	—	—	—	—	—	36·1	vvw
36·8	w	1·283	—	—	—	36·9	m
—	—	—	—	—	—	37·4	vvw
—	—	—	—	—	—	37·8	m
—	—	—	—	—	—	38·7	m
39·5	m	1·208	—	—	—	39·4	s
41·1	m	1·169	—	—	—	41·3	s

Composition and cell content.

The analyses best suited for a determination of the cell content jamesonite are the two made by Prior on selected Bolivian mater

ibed by Spencer (1907b). Table IV gives these analyses with corresponding cell contents obtained in the usual manner, by s of the cell volume and the measured specific gravities. An ative cell content for Prior's second analysis is given using the ly higher specific gravity (5·63) obtained by the writer on Bolivian rial.

TABLE IV. Jamesonite: composition and cell content.

	I.		II.			III.	
	Anal.	Atoms.	Anal.	Atoms.	Atoms.	Comp.	Atoms.
...	41·18	8·04	40·08	7·87	7·99	40·32	8
...	2·76	2·00	2·79	2·03	2·06	2·72	2
..	0·26	0·16	0·22	0·14	0·14	—	—
...	0·01	—	0·13	0·05	0·05	—	—
...	34·53	11·48	34·70	11·59	11·75	35·10	12
...	20·52	25·92	21·37	27·11	27·52	21·86	28
	99·26		99·29			100·00	
r.		5·519		5·546	5·63		5·67 (calc.)

II, Cerro de Ubina, Bolivia; anal. Prior, in Spencer (1907b, p. 311). In I 'there may possibly have been a slight loss of sulphur'.
Ideal composition and cell content.

e there are only two-fold and four-fold positions in the space-C^5_{2h} found for jamesonite, and the sulphur value in analysis I may , the cell content $Pb_8Fe_2Sb_{12}S_{28} = 2[4PbS.FeS.3Sb_2S_3]$ is rather indicated.

nder view of the composition of jamesonite is gained by reducing ailable analyses to atomic proportions with reference to 28 atoms hur indicated for the cell content, as shown in table V. In select-analyses for this table, analyses almost certainly representing gerite[1] were neglected. Only those analyses marked with an k were accepted as certainly jamesonite analyses by Spencer).

average number of Pb atoms is 8·0 which in turn confirms the r of sulphur atoms as 28; Fe and Sb fall close to 2 and 12 respec-and thus the composition $4PbS.FeS.3Sb_2S_3$ is confirmed. This is mposition found by Loczka (1908) and, independently, by r (1911).

ndicated by the much higher lead content of boulangerite and, in some cases, y powder photographs on materials from the localities in question.

TABLE V. Jamesonite: analyses reduced to 28 atoms of sulphur.

	1*.	2*.	3*.	4*.	5*.	6*.	7*.	8.	9.
Pb ...	8·0	7·6	7·6	7·9	8·1	8·9	7·8	8·1	8
Fe ...	1·7	1·9	2·1	2·7	—	2·2	1·5	2·1	2
Cu ...	0·1	0·1	0·1	—	—	0·7	2·2	—	—
Zn ...	—	—	—	0·3	0·2	1·2	0·4	—	—
Ag ...	—	—	—	—	—	—	0·5	—	—
Sb ...	11·4	11·4	10·7	11·0	11·3	11·3	10·8	12·2	11
Bi ...	—	—	—	0·2	—	—	—	—	—
As ...	—	—	—	—	—	—	0·1	—	0
S ...	28·0	28·0	28·0	28·0	28·0	28·0	28·0	28·0	28

	10.	11.	12.	13.	14*.	15*.	16.	17.	Aver
Pb ...	7·8	7·5	7·5	8·2	8·7	8·1	7·9	8·2	8
Fe ...	(4·9)	(3·7)	1·8	2·7	2·2	2·1	2·0	2·8	2
Mn ...	—	—	—	—	—	—	0·1	—	—
Cu ...	—	—	trace	0·2	0·2	0·1	trace	—	—
Zn ...	—	—	—	—	—	—	0·1	—	—
Ag ...	—	—	0·1	trace	trace	trace	—	—	—
Sb ...	11·2	11·2	11·7	11·9	12·4	12·0	12·2	11·3	11
S ...	28·0	28·0	28·0	28·0	28·0	28·0	28·0	28·0	28

1, 2, 3, Cornwall; anal. Rose (1826, 1829). 4, 5, Spain; anal. Schaffgotsch (18
6, Harz; anal. Rammelsberg, in Zincken and Rammelsberg (1849, p. 242).
Argentina; anal. Siewert, in Stelzner (1873, p. 248). 8, Arkansas; anal. Dunning
(1877) (less ZnS). 9, Tirol; anal. Sarlay, in Pichler (1877). 10, Bolivia; a
Kiepenheuer, in vom Rath (1879). 11, Spain; anal. Genth (1879) (less pyr
12, Arkansas; anal. Wait (1879). 13, Italy; anal. Lotti, in Novarese (1902). 14
Bolivia; anal. Prior, in Spencer (1907b). 16, Felsőbánya; anal. Loczka (19
17, Idaho; anal. Shannon (1925).

Summary.

Jamesonite from Cornwall (type locality) and several localities
Bolivia gives identical X-ray powder photographs. Rotation and e
inclination Weissenberg photographs on a needle from the Itos m
near San Felipe de Oruro, Bolivia, give monoclinic symmetry. Sp
group, $C^5_{2h} = P2_1/a$. Cell edges, a 15·68±0·05, b 19·01±0·05, c (ne
axis) 4·03±0·01 Å.; β 91° 48′±30′. Twin-plane (100). Cell cont
$Pb_8Fe_2Sb_{12}S_{28} = 2[4PbS.FeS.3Sb_2S_3]$. Sp. gr. 5·63 (highest of 7 meas
ments on different samples), 5·67 (calculated). Polished sections
white, strongly anisotropic; they show good basal and longitud
cleavage. The powder pattern agrees with that obtained by H
(1938) on jamesonite from fourteen localities. Jamesonite may
distinguished from boulangerite by a microchemical test for iron, w
gives a strong positive reaction with jamesonite, and by a positive e
test with KOH on polished sections.

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Description of Plates XXVI and XXVII.

Plate XXVI. Jamesonite. Polished sections with vertical illumination a crossed nicols.

Fig. 1. Cornwall (material 3), showing the needle-like to columnar habit and t transverse (basal) and longitudinal cleavages. The anisotropism is also clea shown. ×92.

Fig. 2. Bolivia (material 4), parts of two crystals showing the basal and longi dinal cleavages. ×33.

Plate XXVII. Jamesonite. X-ray photographs with copper radiation, radius cameras $360/4\pi$ mm. (1 mm. = 1 degree θ).

Fig. 1. Rotation about the needle-axis c [001]. 3·9 KWH. (unfiltered).

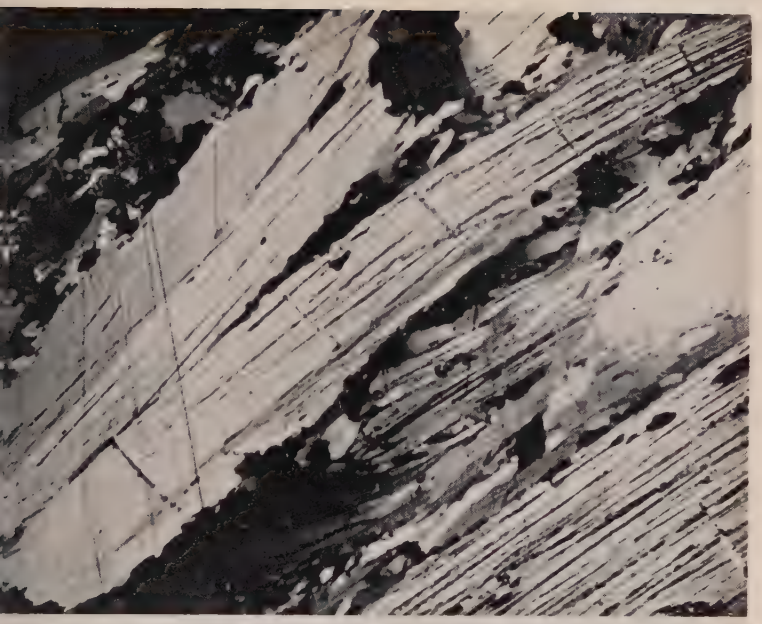
Fig. 2. Weissenberg photograph of the zero layer-line ($hk0$). 21·2 KW (unfiltered).

Fig. 3. Weissenberg photograph of the first layer-line ($hk1$), showing the duplic tion of α spots due to twinning. 25·9 KWH. (unfiltered).

Fig. 4. Cornwall (material 2). Powder photograph. 5·0 KWH. (nickel filter)

Fig. 5. Bolivia (material 4, needles). Powder photograph. 7·9 KWH. (nick filter).

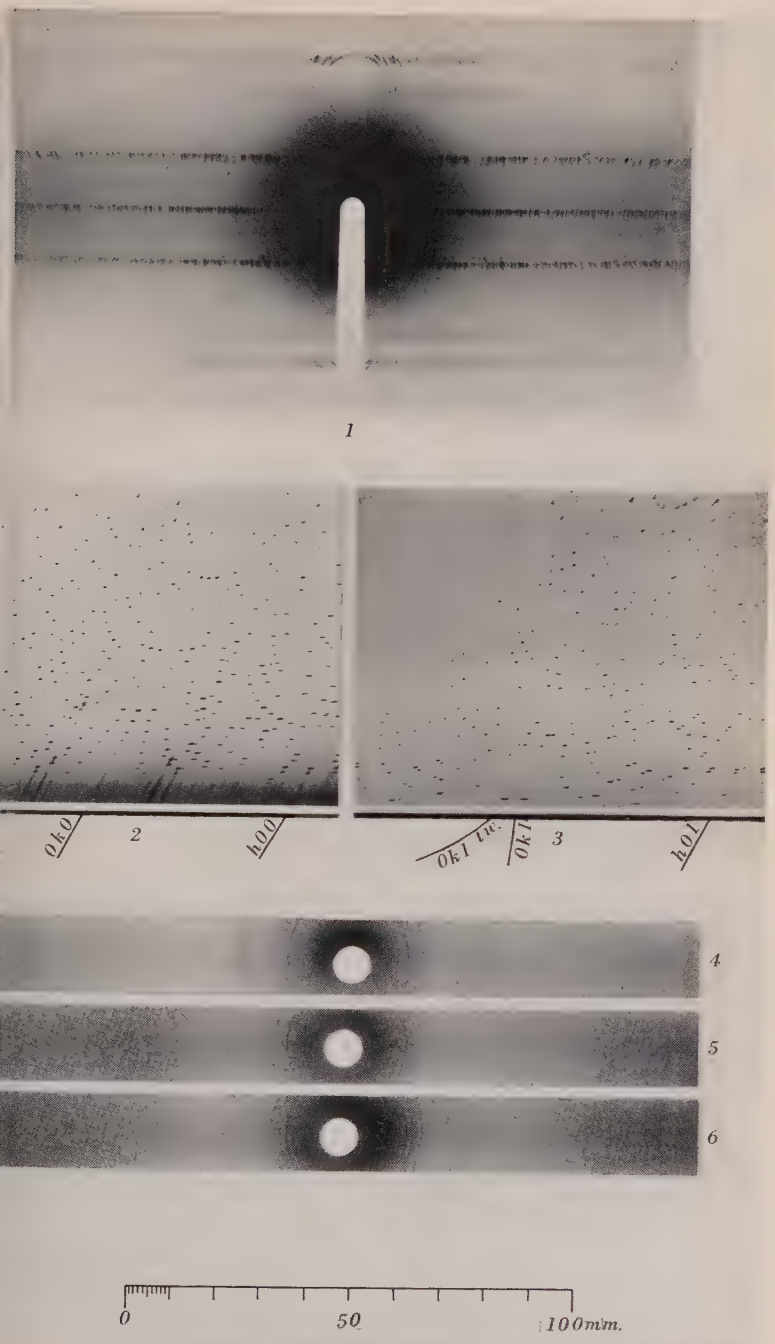
Fig. 6. Bolivia (material 5, hair-like fibres). Powder photograph. 8·9 KW (nickel filter).



1

2

L. G. Berry: Polished sections of jamesonite.



L. G. Berry: X-ray photographs of jamesonite.

Bravoite from Mill Close mine, Derbyshire.

By F. A. Bannister, M.A.
with chemical analysis by M. H. Hey, M.A., D.Sc.
Mineral Department, British Museum.

(With Plate XXVIII.)

[Read June 6, 1940.]

EARLY this year Mr. Arthur Russell brought me a small specimen of ore from Mill Close mine, Wensley, Derbyshire, for identification. X-ray powder photograph pl. xxviii, fig. 3, showed that the mineral the pyrite structure with unit-cell edge a 5.49 Å., and a chemical lysis of a small sample of specific gravity 4·82, yielded Ni 16·69, 29·30, S 53.40 % (see table 1). These data identified the specimen as voite, a rare mineral new to the British Isles. At a later date Pro- or W. G. Fearnsides interested himself in our preliminary work and ly provided me with further specimens of bravoite and accessory erals from the Mill Close mine. These also have been investigated. rior to W. F. Hillebrand's analysis in 1907[1] of an iron nickel sulphide the vanadium ore of Minasragra, Peru, the nickel content of pyrite never been reported to exceed 6 %. Hillebrand found that the nickel tent of the minute grains of sulphide picked from the vanadium ore 15·7 %. 'Should it seem proper to give it a specific name later, *voite* is suggested', after Señor José J. Bravo, the Peruvian writer on vanadium occurrence at Minasragra. A. F. Buddington[2] has de- bed Alaskan bravoite containing 19·6 %, and P. B. Nye[3] bravoite n Tasmania with 25·42 %, Ni. Only W. F. de Jong and H. W. V. lliams[4] have previously published X-ray data on chemically analysed voite.[5] This mineral with unit-cell edge 5·57 Å. comes from Mecher- h, Rhenish Prussia, and contains as much as 24·73 % Ni and 3·28 % Co. As far as I can judge from the descriptions in the literature and the

W. F. Hillebrand, Amer. Journ. Sci., 1907, ser. 4, vol. 24, p. 149.
A. F. Buddington, Econ. Geol., 1924, vol. 19, p. 521. [M.A. 2–447.]
P. B. Nye, Tasmania Geol. Surv. Bull., no. 39, p. 22. [M.A. 4–229.]
W. F. de Jong and H. W. V. Willems, Zeits. Anorg. Chem., 1927, vol. 160, 89. [M.A. 3–339.]
G. Kalb and E. Meyer, Centralblatt Min., Abt. A, 1926, p. 26. [M.A. 3–154.]

comparison of a small amount of Hillebrand's original bravoite and specimen of bravoite from Mechernich in the mineral collections of th British Museum, the bravoite from Mill Close mine, although no abundant, occurs in much finer specimens than elsewhere.

The largest of the specimens presented by Professor Fearnsides come from a cavern below the second toadstone at the 170-fathom level o the northern extension of the Mill Close mine. The bravoite has bee deposited on the toadstone (altered at the contact mainly to granula quartz) in radiating nodular layers up to $1\frac{1}{2}$ inches thick. On a fres fracture the mineral exhibits a bright silvery lustre with a yellow tin like calaverite. Weathered surfaces are tarnished to a pinkish tint. Th crystal terminations on the nodular surface of the bravoite crusts sho pyritohedral faces close to (210) rather than octahedral termination commonly seen on pyrite nodules. The bravoite intergrown with calcit is succeeded by a compact mass of chalcopyrite intergrown with tetra hedrite and a little galena. The chalcopyrite-tetrahedrite ore is enclose by a vein of large scalenohedral crystals of calcite and nodular pyrit encrusted with fine-grained marcasite. The calcite crystals are fille with marcasite inclusions. Mr. Russell tells me that purple fluorspa also has its place in this mineral sequence. It is to be hoped that in du course Mr. Russell will himself contribute a more satisfactory accoun of the bravoite occurrence at Mill Close mine.

The material detached from Mr. Russell's specimen for chemica analysis and X-ray work was carefully examined on fractured surface and also when coarsely crushed for any inclusions of other mineral Polished sections prepared by Dr. W. R. Jones in the Royal School o Mines from bravoite specimens collected by himself with Mr. Russe at Mill Close mine fail to show any trace of enclosures and the minera is completely homogeneous. It is also obvious from the good summatio of Dr. Hey's semimicro-analysis in table 1 and the fair agreement of th observed and calculated specific gravity that he analysed uniform material free from admixture with pyrite or chalcopyrite. The analyse of bravoite from other localities including Hillebrand's are also give in table 1 for comparison.

X-ray work on Hillebrand's material from Peru shows that the speck of bravoite enclosed in carbonaceous shale have the pyrite structur They are not single crystals, however. They give only a weak powde pattern with broad high-order diffractions which show that the minera is very fine-grained or imperfectly crystallized. The lines approximat in position to those of the Mill Close mineral rather than to those o

e, but an accurate cell-edge measurement is impossible. Both
ites from Mill Close mine and Mechernich, however, yield sharply
ed X-ray photographs and it has been possible to measure the
sponding unit-cell edges accurately.

ray and chemical work has also been carried out upon the pyrite
Mill Close mine. A polished specimen of pyrite detached from the
specimen described above
ls a core of pale-yellow
e P (fig. 1) separated from
ter zone of a pinkish-grey
ral (dark-grey on the re-
uction) by a thin vein of
a. This vein can be seen
diately to the left of P
thin white line. The
er photograph of the
h-grey zone has been re-
ced in pl. XXVIII, fig. 4,
shows in contrast to the
r photographs of the
minerals pyrite and
ite in figs. 2 and 3 double
instead of single ones.
material consists of ad-

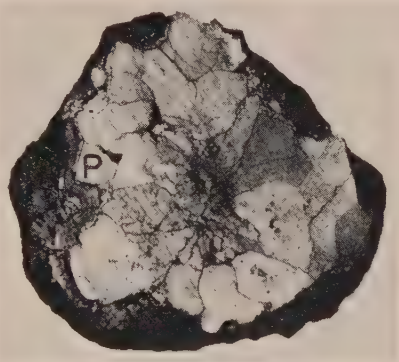


FIG. 1. Polished section of a nodule of coarsely granular pyrite (light-grey) with a veinlet of galena (white, seen to the left of P) surrounded by a minutely granular mixture (dark-grey) of pyrite and bravoite. ×3.

d granular pyrite and bravoite. The granular bravoite, however,
spacing of 5·57 Å., which is close to the value of the cell-edge
ravoite from Mechernich. Dr. Hey finds that the nickel content
is pinkish-grey granular zone is 12 %. Assuming that this granular
ite from Mill Close mine contains as much nickel as the Mechernich
ial, we have calculated that 43 % of the bravoite would be needed
mixture with ordinary pyrite to yield Dr. Hey's nickel figure. It
parent that both the lines of each doublet in fig. 4 have about the
intensity, suggesting about equal amounts of bravoite and pyrite.
is therefore very probable that two types of bravoite exist at Mill
mine, the more abundant and well-crystallized nodular mineral
ining 16·69 % Ni (X-ray photograph pl. XXVIII, fig. 3) and a much
zone of granular material containing about 28 % Ni mixed with
lar pyrite (X-ray photograph, fig. 4). Dr. Hey cannot detect
a trace of nickel in the pyrite core represented in fig. 1, and so far
ave no evidence that any other members of the bravoite-pyrite

series exist at Mill Close mine. This is rather surprising in view of known existence of nickeliferous pyrite from many localities usu containing not more than 6 % Ni. Recently E. Thomson and J. S. Al have described a nickeliferous pyrite from Sudbury, Ontario, wh contains Ni 6·5 % and yet when X-rayed gives the normal spacing common pyrite.

TABLE I. Analyses of bravoite, &c.

	1.	2.	3.	4.	5.	6.	7.	8
Fe	29·30	17·08	29·46	25·19	28·4	20·68	38·54	–
Ni	16·69	24·73	18·23	25·42	19·6	24·81	6·50	45·6
Co	trace	3·28	trace	0·35	—	—	—	–
S	53·40	51·15	52·31	49·04	[50·1]	54·51	51·39	54·
Cell-edge ...	5·49	5·57	5·5 *c.*	—	—	—	—	5·7
Nickel atoms per unit cell	1·41	2·42*	1·48	—	—	—	—	

* Includes cobalt.

1. Mill Close mine, Derbyshire; on 80 mg. M. H. Hey, total 99·39. Sp. g nodular mass 4·82, calc. 4·80.
2. Mechernich, Rhenish Prussia; also Cu 0·47 and insol. 0·40, total 97·11 (and Meyer, loc. cit.).
3. Minasragra, Peru; original analysis by Hillebrand recalculated to ex V_2O_3 4·31.
4. Main creek, Adamsfield district, Tasmania; recalculated omitting 7·80 found by Nye (loc. cit.).
5. Spirit Mountain deposits, Canyon Creek valley, Lower Copper river v Alaska. Sulphur by difference; the recalculation made by Overbeck together the figures obtained by W. T. Schaller for material solubl insoluble in HCl. Bull. U.S. Geol. Surv., 1920, no. 712, p. 97.
6. Same locality as 5. Analysed by A. H. Phillips (in Buddington, loc. cit., p and recalculated to exclude impurities.
7. Nickeliferous pyrite from the Denison mine, Sudbury district, Ontario; 3·80, total 100·23. Thomson and Allen, loc. cit., p. 137.
8. Artificial nickel disulphide prepared by de Jong and Willems.

Fig. 5 shows the unit-cell nickel-content of bravoite specimens also of artificial nickel disulphide (prepared and studied by de Jong Willems, loc. cit., p. 185) plotted against the unit-cell edge. apparent from the direction of the curve that can be drawn throug known points that pyrite containing 6½ % Ni, i.e. ½ atom per uni should have a spacing of 5·42 A. Thomson and Allen have either to detect the difference between this value and that of ordinary p 5·405 A., or there is a discontinuity in the series of known mixed cr FeS_2–$(Fe,Ni)S_2$. Judging from the account of their optical data

[1] E. Thomson and J. S. Allen, Univ. Toronto Studies, Geol. Ser., 1939, p. 135. [M.A. 7–510.]

be little chance of their results corresponding to a mixture of com- pyrite and bravoite.

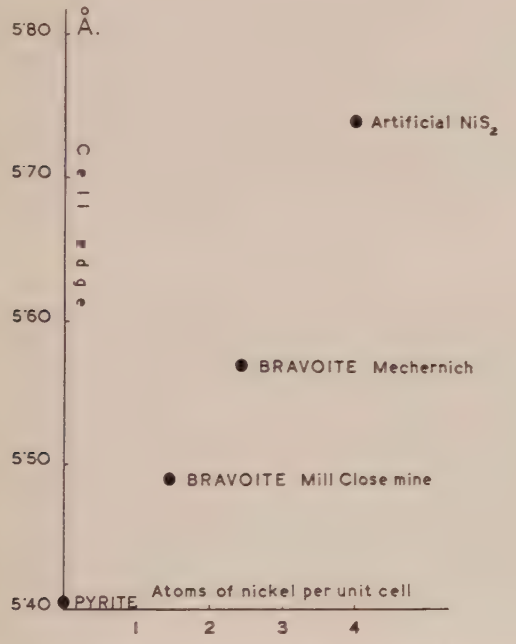


FIG. 5. Cell-edge dimensions and nickel-content of bravoite.

far no bravoite has been described with a nickel-content exceeding t 25 %, and the suggestion that violarite[1] approaches nickel disul- de in composition and may therefore be a member of the pyrite- voite series can only be accepted if X-ray work yet to be carried out ws that the mineral has the pyrite crystal-structure and does not ong to the spinel type. Neither has a bravoite yet been described h nickel-content between 6·50 and 16·69 %, so that a discontinuity he pyrite-bravoite series may exist in this region. The problem may more of paragenetic than chemical interest. There is need for theses of artificial bravoites and pyrites with various nickel-contents to pure nickel sulphide. It will be imperative not only to carry out ay measurements on analysed specimens but to prepare samples able for the preparation of polished sections to test for homogeneity.

W. Lindgren and W. M. Davy, Econ. Geol., 1924, vol. 19, p. 309. [M.A. 2–338.]
N. Short and E. V. Shannon, Amer. Min., 1930, vol. 15, p. 12. [M.A. 4–335.]

In this way it should be possible not only to check apparent disco tinuities in the naturally occurring pyrite-bravoite series but also decide whether the unit-cell edge of pyrite remains the same up to nickel-content of $6\frac{1}{2}$ %.

Explanation of Plate XXVIII.

X-ray powder photographs of pyrite and bravoite from Mill Close mine, Derb shire, taken with unfiltered iron radiation $\lambda = 1{\cdot}934$ Å., and with the sar cylindrical camera diameter 6·04 cm. A length of 15 cm. on all the original films equivalent to 10 cm. on the reproduced figures.

Fig. 2. Pyrite, a standard photograph. The photograph of the pyrite from t nodule, fig. 1, was taken with a rotating fragment and is not so suitab for reproduction but agrees precisely with the standard.

Fig. 3. Bravoite containing 16·69 % Ni.

Fig. 4. Granular mixture of about equal proportions of bravoite (about 28 % N and ordinary pyrite.

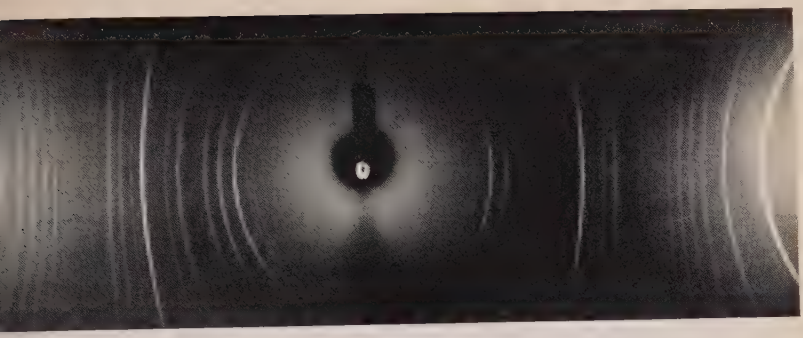


Fig. 2

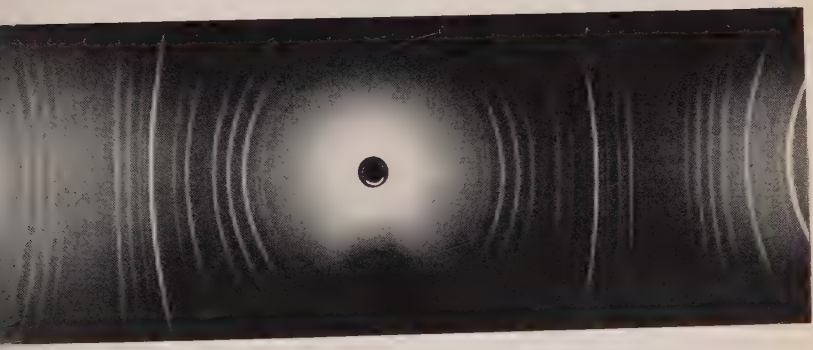


Fig. 3

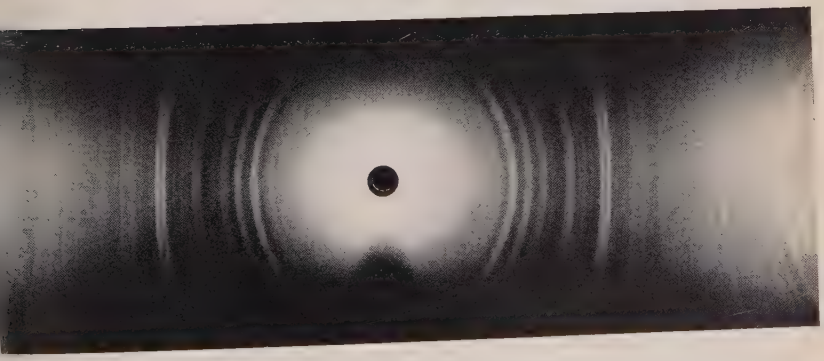


Fig. 4

F. A. Bannister: X-ray photographs of bravoite and pyrite.

The Tauq, 'Iraq, meteorite.

By W. A. Macfadyen, M.C., M.A., Ph.D., F.G.S.
Formerly Government Geologist of 'Iraq,
and G. F. Claringbull, B.Sc., Ph.D., F.G.S.
Assistant-Keeper in the Mineral Department of the British Museum.

[Read June 6, 1940.]

Circumstances of the Fall (W.A.M.)

December 1933 Major W. A. Pover, who was then 'Iraq Public Works Department Executive Engineer of the Mosul and Kirkuk ...s, showed the writer a portion of a meteoritic stone. This had been ...s office doing duty as a paper-weight since it was brought to him ...wo of his men shortly after its fall.

... that time Major Pover was in camp, supervising the erection of ...ermanent steel road bridge that spans the river valley some five ...etres upstream of Tauq village. His men told him that the ...rite fell in the middle of the night; it was likened by those who ...it to the moon falling, and people were awakened by the jolt of its ... When the morning came, some of his men went out to seek it, ...hey in fact found it. They described it as about two and a half feet ...ameter, and they broke it up with a sledge hammer, when the ...nents were eagerly collected by those who happened to be present. ...rtion they themselves took to Major Pover.

...e precise date of the fall Major Pover was unable to recollect, but ...mpression was that it was probably in August. The building of the ... bridge at the time definitely fixed the year as 1929.

...e writer discussed the matter with the Chief of Police in Tauq later ...34. The fall was clearly remembered by certain residents of Tauq, ...o even approximate date could be obtained. It was something that ...happened in the past, and that was all that they could say. A ...ment, perhaps five centimetres in greatest diameter, of what ...ared to be the same stone, with rusty patches on it, probably due ...etting and oxidation, was obtained from a resident. This was not ...n by the writer at that time, and when later, on August 4, 1935,

an attempt was made to obtain it, it could no longer be found. It
learned earlier, however, that the headman of the hamlet of Tawi
close to where the meteorite actually fell, was still living there. T
man, a peasant farmer named, I think, Omaiyir Abu Mutalak,
sought out. He well remembered the occurrence, and on January
1934, took the writer to within half a kilometre of the alleged sp
when the motor-car was stopped by impassable dikes. Since there
then said to be nothing to see at the precise spot and no proof of
being so, this was not actually visited.

The headman stated that he was at Tawila when the meteorite
'one morning'. Pressed as to the approximate time, he could give li
more exact information, clocks apparently not being much used
Tawila; but it appeared to be well after sunrise, and before noon.
had no precise recollection of the date. The year he could not give,
it was 'at the reaping time of the barley'. Barley is reaped in the T
district from about April or May onwards. Some was still standing in
fields round Kirkuk in the middle of July 1934, so that his date for
fall may perhaps be construed as some time between April and Aug

He stated that the meteorite made a swishing sound as it fell,
compared it with that made by the passage of a shell; he was poss
familiar with such a noise from the war time, since he was now a mid
aged man of 40 or 50 years. The whole meteorite was originally ab
the size of a man's head, and it broke into three parts when it hit
ground. It apparently did not go deeply into the ground, though t
is alluvial hereabouts.

He claimed that he reached the stone within quite a short time o
fall, a matter of perhaps a quarter of an hour, but owing to his
familiarity with the precise measurement of time it was difficul
establish this estimate. Asked whether it was hot when he reache
he replied, 'By God, I cannot tell a lie, it was not.'

On August 4, 1935, the writer met the Mullah Said Mustafa of
mosque Imam Zain al Abdin, 2 km. north-east of Tauq. The Mu
clearly recollected hearing about the fall of the stone at the time,
could give neither date nor details.

On news of the Tauq meteorite reaching Dr. L. J. Spencer, F.

[1] The name Tawila, an Arabic word meaning 'long', is not infrequently used
topographical name, e.g. of villages, islands, &c., in Arab countries. It is, there
preferred to attach to the meteorite the name of Tauq, a larger and much b
known village near by, as more characteristic. Tauq is a Turkish word, appar
meaning 'chicken', and there is a movement in 'Iraq for renaming the vi
Daquq, which apparently sounds more dignified in Arab ears.

Keeper of the Mineral Department of the British Museum, he ed that Captain R. S. Cooke, who had once acted as Honorary tor of the Museum and Antiquities service in Baghdad, had in 1932 presented to the British Museum a partly crusted fragment meteoritic stone. Captain Cooke stated that the stone had been ned by Mullah Abd al Qadir, Mudir of the Madraset al 'Ilmiya in uk. It was reported to have fallen at Kirkuk, in a field between the ay station and the town, one day at 1 p.m. A crash was heard by e working in the field. The only date that Captain Cooke could was that it was said to have fallen, he believed in April, before the of Miss Gertrude Bell on July 12, 1926, but whether the fall was 25 or 1926 he could not be sure. He said that he first heard of it a paragraph in the 'Baghdad Times' of 1925 or 1926, but he could roduce this.

orts to obtain further information and confirmation of these state- s made by Captain Cooke have been without avail. A request for nation was sent by Dr. Spencer to the British Embassy in Baghdad. eply dated April 11, 1934, Captain V. Holt, the Oriental Secretary, that the British Vice-Consul at Kirkuk had been unable to any information concerning the fall of a meteorite there from cal inhabitants, and Mullah Abd al Qadir had no recollection of nother query was addressed to Dr. Julius Jordan, Director of ities, Antiquities Department, 'Iraq, but that also elicited no r information.

writer independently sought out Mullah Abd al Qadir, and found t Kirkuk on November 11, 1935. He said that Captain Cooke, he knew quite well, had come to him one day, probably with the ent, and asked him if he knew anything about its fall. This, said Qadir, was the first he had heard of such an occurrence, and he o more knowledge of the matter now than then. He said he nly did not give any specimen to Captain Cooke.

writer wrote to the editor of the ''Iraq Times' newspaper, which successor of the 'Baghdad Times', asking if the alleged paragraph the meteorite in the latter could be found. A reply dated Decem- 1934, stated that one of the clerks had made a search of the files 25 and 1926, and also for the summer of 1929, but was unable to ny account of the fall of a meteorite in 'Iraq.

tter was therefore written to the ''Iraq Times', and published in h in the issue of February 18, 1935, giving the substance of the s accounts detailed above, and asking readers to give any

information they might have on the matter. A condensed versio the letter and request also appeared in Arabic in the Baghdad ne paper 'Al Bilad' on February 19, 1935. Neither of these appeals yiel any germane reply.

Short of some fortunate and adventitious accession of information, resources of inquiry appear to have been exhausted, and it remain review the evidence.

The 'Kirkuk' meteorite, apart from the actual fragment, rests sc upon Captain Cooke's statement, none of the details of which it has b possible to verify. The present writer has found no evidence of fall of a meteorite in Kirkuk, either amongst the inhabitants of neighbourhood or otherwise. The specimen given by Captain Cook the British Museum appears to be indistinguishable from the T meteorite. It seems unlikely that two such similar meteorites sh have fallen within three or four years of each other, so near togethe Kirkuk and Tawila near Tauq, which are distant only some 24 The inference is that only one meteorite fell, the first to be recor from 'Iraq, and that the alleged Kirkuk meteorite was both wro located and dated.

The differences in the three versions of the circumstances of the may be ascribed partly to the imperfect recollections of untra minds describing an unusual event, and perhaps to embroidery adde Major Pover's men who recounted the tale, possibly already at sec hand, 'to give artistic verisimilitude to a bald and unconvin narrative'. Certain of the statements are mutually contradictory, do not seem explicable except as above; for instance, the time of fall, stated to have been in the forenoon and 1 p.m. on the one h a fair agreement, and in the middle of the night on the other.

In the writer's view the evidence points to the following presumpt based mainly on the first-hand account of the headman of Tawila, w evidence seems the most reliable. The other two accounts are at l second- or third-hand.

A stony meteorite about the size of a man's head fell with a swis sound in open country half a kilometre east of Tawila hamle lat. 35° 10′ N., long. 44° 20′ E., which is 11 km. north-west of village of Tauq, in 'Iraq. It fell during the day-time, about or be noon, some time in the summer of 1929, between April and Aug It did not penetrate deeply into the hard alluvial ground, an broke into some three pieces as a result of the impact. It was appreciably hot when it fell.

Description of the Meteorite (G.F.C.)

he portion of the Tauq meteorite available for study consists of fragments (B.M. 1936, 151) fitting together and measuring over all $\times 11 \times 7$ cm. (fig. 1). The total weight is 1355 grams, the larger

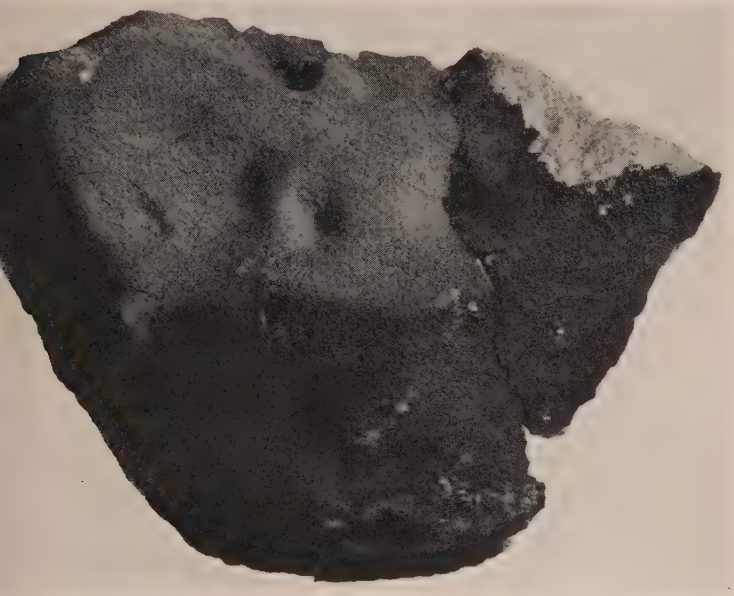


Fig. 1. The Tauq meteorite. $\times \frac{2}{3}$.

ment weighing 1156 grams. When united along the common frac- the mass exhibits a ridge with the adjacent slopes approximately ight angles and well-defined 'thumb-marks'. The whole of the ace surrounding the ridge (rather more than half that of the united s) is covered by a black crust having a fairly constant thickness of m. The rough glassy surface of the crust is interrupted only very sionally by a smooth area of a few square millimetres where a ndrule makes contact with it on the inside.

he interior of the meteorite is yellowish-grey and a comparatively ll amount of troilite and nickel-iron is scattered irregularly through mass. A number of poorly defined chondrules, 3–8 mm. in diameter, erally darker but occasionally lighter in colour than the main mass distinguishable in the hand-specimen.

nother 205-gram fragment (B.M. 1932, 1094) of a meteorite said to

have fallen at Kirkuk, 24 km. from Tawila near Tauq, shows a sm area of the black crust. It is indistinguishable macroscopically and thin section from the Tauq material, and almost certainly represe another portion of the same fall. The Tauq meteorite is thought have weighed about 6–7 kg. and it is not therefore surprising that t Kirkuk specimen cannot be fitted to the Tauq fragments. The pet graphic description is based upon sections of both specimens.

The meteorite, a white chondrite, is seen in thin section to be granular character with fairly numerous chondrules often poorly d fined. The minerals present are hypersthene (γ 1·687 $\pm$0·002), livi (γ 1·708 $\pm$0·002), anorthite, troilite, nickel-iron, and a few minute grai of chromite (?). Of these the olivine and pyroxene in approximate equal proportions are by far the most abundant, forming a granul mass in which the chondrules are embedded. Individual grains rare exceed 1 mm. in maximum dimension and are generally considerab smaller. Several types of chondrule occur: granular olivine surround by a halo of nickel-iron and troilite granules; fine-granular olivi pyroxene clusters peppered with iron and troilite; sheaf-like pyroxe bundles; nests of irregularly arranged pyroxene fibres; narrow paral olivine lamellae; olivine and pyroxene rimmed by stumpy olivine nests of three or four poecilitic pyroxene crystals. Interstitial anorthi commonly shows undulose extinction. The distribution of troilite a nickel-iron, which are distinguishable in the ordinary covered secti in oblique surface illumination, has been confirmed by the applicati of test papers to the sawn surfaces.[1] Troilite is occasionally periphe to the nickel-iron. The proportion of opaque minerals is estimated about 3 %, and the Mg/Fe ratio is roughly 5/1.

A cross-section of the crust reveals an outer black slaggy skin rare exceeding 0·1 mm. in width and crenulate on the exterior. Passi inwards there is a tendency for olivine to predominate for the fi 0·2 to 0·3 mm., but the remaining and widest band consists of troili enclosing nickel-iron and occasional grains of olivine. While the cru as a whole is parallel-sided the inner margin is rendered irregular by t penetration of the ferromagnesian crystals of the main mass. Th crust is strikingly similar to that of the Rangala meteorite.[2]

[1] Method of imprints, Min. Abstr., **6**–377, **7**–110, 556, 557.

[2] J. A. Dunn, Rec. Geol. Surv. India, 1939, vol. 74, p. 267. [M.A. **7**–541.]

Fifteenth list of new mineral names; with an index of authors.[1]

By L. J. Spencer, C.B.E., M.A., Sc.D., F.R.S.

Formerly Keeper of Minerals in the British Museum.

[Communicated June 6, 1940.]

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ukumalite. S. Hata, 1938. Sci. Papers Inst. Phys. Chem. arch, Tokyo, 1938, vol. 34, p. 1018. Phospho-orthosilicate of rium and calcium, $CaYt_2(Si,P)_2O_8$, hexagonal and isomorphous with olite. Named from the locality, Abukuma range, Fukushima, n. F. Machatschki (Zentr. Min., Abt. A, 1939, p. 161) regards it yttrium silicate apatite. [M.A. **7**–225, 395.]

digeite. N. E. Efremov, 1939. Compt. Rend. (Doklady) Acad. URSS, vol. 22, p. 433 (Adigeite). A mineral of the serpentine p with the composition $5MgO.3SiO_2.3\frac{1}{2}$–$4H_2O$, from Mt. Tkhach, ern Caucasus. This is perhaps the 'new variety of serpentine' bed, without name, by the same author in Bull. Acad. Sci. URSS, Géol., 1938, p. 107. [M.A. **7**–221, 370.]

kali-apatite. D. McConnell, 1938. Amer. Min., vol. 23, pp. 10, 17 li-apatites). To include the apatite-like minerals dehrnite and tonite (12th List). [M.A. **7**–88.]

umo-berezovite, Alumo-chrompicotite. S. A. Vakhromeev *et* 1936. Trans. All-Union Sci. Research Inst. Econ. Min. USSR, , p. 225 (алюмо-березовит, алюмо-хромпикотит). Members of the l group with the composition $(Fe,Mg)O.(Cr,Al)_2O_3$ (alumo-ovite) and $(Mg,Fe)O.(Cr,Al)_2O_3$ (alumo-chrompicotite). *See* Bere-ite. [M.A. **7**–151.]

umodeweylite. N. E. Efremov, 1939. Compt. Rend. (Doklady) Sci. URSS, vol. 24, p. 287 (alumodeveillites). Hydrated silicates

revious lists of this series have been given every three years at the ends of 1–24 (1897–1937) of this Magazine. The 1506 names in the first ten lists are ed in one alphabetical arrangement in the General Index (1926) to vols. 11–20 1925). References to 'Mineralogical Abstracts' are given in the form 7–225].

of aluminium and magnesium intermediate in composition betwe montmorillonite and sepiolite, or mixtures of these. [M.A. 7–419.]

Aminoffite. C. S. Hurlbut, 1937. Geol. För. Förh. Stockhol vol. 59, p. 290 (Aminoffite). Hydrous silicate of calcium, beryllium, a aluminium, $Ca_8Be_3AlSi_8O_{28}(OH).4H_2O$, as colourless tetragonal crysta related to meliphane, from Sweden. Named after Dr. Gregori Amin (1883–) of Stockholm. [M.A. 7–119.]

Anchi-zeolite. W. E. Richmond, 1937. Amer. Min., vol. 22, p. 2 (anchi-zeolite). A term to include such minerals as prehnite, datoli babingtonite, &c., formed during a late hydrothermal phase of igneo activity, before the zeolite phase. Named from ἄγχι, near, and zeoli [M.A. 7–118.]

Antofagastite. C. Palache and W. F. Foshag, 1938. Amer. Mi vol. 23, p. 85; M. C. Bandy, ibid., p. 705. Hydrated copper chlori $CuCl_2.2H_2O$, as bluish-green orthorhombic crystals from provin Antofagasta, Chile. Named from the locality. [M.A. 7–59, 223.]

Armenite. H. Neumann, 1939. Norsk Geol. Tidsskrift, vol. p. 312 (Armenite). Hydrated alumino-silicate of calcium and bariu $BaCa_2Al_6Si_8O_{28}.2H_2O$, as colourless pseudo-hexagonal (orthorhombic crystals from Armen mine, Kongsberg, Norway. Named from t locality. [M.A. 7–468.]

Arsen-rösslerite. O. M. Friedrich and J. Robitsch, 1939. Zen Min., Abt. A, 1939, p. 143 (Arsen-Rößlerit). Synonym of rössler ($MgHAsO_4.7H_2O$), which is used as a group name to include a phosphor-rösslerite (q.v.). [M.A. 7–317.]

Asbophite. N. D. Sobolev, 1930. [Min. Syre, Moscow, vol. 5, no p. 1181.] V. N. Lodochnikov, Trans. Centr. Geol. Prosp. Inst. USS 1936, no. 38, pp. 34, 517, 604 (асбофит), p. 729 (Asbophite). O. Shubnikova, Trans. Lomonosov Inst. Acad. Sci. USSR, Ser. Min., 19 no. 10, p. 195. A variety of chrysotile-asbestos, $42H_4(Mg,Fe)Mg_2Si_2O$ $(Al,Fe)_2O_3+8SiO_2$; sp. gr. 2·5847, α 1·557, γ 1·569. A contraction asbestos+ophite.

Askanite. D. S. Belyankin, 1934. Trav. Inst. Pétrogr. Acad. URSS, no. 6, p. 110 (Асканит), p. 114 (askanite). O. M. Shubniko Trans. Lomonosov Inst. Acad. Sci. USSR, 1937, no. 10, p. 201 (Аскан Ascanite). D. S. Belyankin and V. P. Ivanova, Compt. Rend. (Dokla

d. Sci. URSS, 1938, vol. 18, p. 279 (Askanite). A montmorillonite-clay occurring as a decomposition product of volcanic ash. Named n the locality, Askana (Аскана), Ozurgety district, Georgia, Trans-asia. [M.A. 7–426.]

yasite. J. D. Buddhue, 1939. Popular Astronomy, Northfield, nnesota, vol. 47, p. 97. The names rustite and ayasite are suggested the rust or iron-shale formed by the oxidation of meteoritic irons. med from the Sanskrit *ayas*, iron. [M.A. 7–266.]

zovskite. N. E. Efremov, 1937. Trans. Lomonosov Inst. Acad. Sci. SR, no. 10, p. 151 (Азовскит), p. 154 (Asovskite), p. 155 (azovskite). lrated ferric phosphate, $FePO_4.2Fe(OH)_3.3H_2O$, as dark brown ses with pitchy lustre in the iron ore on the Taman shore of the f Azov (Азовское Море). Named from the locality. [M.A. 7–59.]

andylite. C. Palache and W. F. Foshag, 1938. Amer. Min., vol. 23, 7; M. C. Bandy, ibid., p. 704. Hydrated borate-chloride of copper, $_3O_4.CuCl_2.4H_2O$, as dark blue tetragonal crystals from Chile. ned after Mark Chance Bandy, mining engineer, who collected the eral. [M.A. 7–59, 223.]

arium-albite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido ., Ser. 4, vol. 4, p. 385 (Bariumalbite). A soda-potash-felspar con-ng $BaAl_2Si_2O_8$ 14 %. [M.A. 7–413.]

edenite. N. E. Efremov, 1935. [Min. Syre, Moscow, 1935, no. 9, 5]; Mém. Soc. Russe Min., 1937, ser. 2, vol. 66, p. 479 (Беденит), 485 (Bedenite). O. M. Shubnikova, Trans. Lomonosov Inst. Acad. USSR, 1937, no. 10, p. 183. An asbestiform mineral of the antho-llite group, $H_2Ca_2Mg_4AlFe'''Si_8O_{26}$, from Beden Mtn., northern casus. Named from the locality. [M.A. 7–170.]

erezovskite. E. S. Simpson, 1932. A key to mineral groups, cies and varieties, London, p. 8 (Beresofskite). To replace the ier name, beresofite (E. S. Simpson, Min. Mag., 1920, vol. 19, 101–105), for a magnesium variety of chromite. Beresofite of U. Shepard (1844) is an obsolete synonym of crocoite, $PbCrO_4$. esovite (Beresowit) of J. (= Y. V.) Samoilov (1897; 2nd List) is $O.3PbCrO_4.PbCO_3$. Beresite of G. Rose (1837) is a microgranite artz-aplite). All are named from the locality, Berezovsk (Березовск), ining village 13 km. NE. of Ekaterinburg (now Sverdlovsk), Urals. Alumo-berezovite.

Bidalotite. B. Rama Rao and L. Rama Rao, 1937. Proc. Indi Acad. Sci., Sect. B, vol. 5, p. 290. An orthorhombic pyroxene differi from hypersthene in containing Al_2O_3 (5–10 %) and in its optic characters. Named from the locality, Bidaloti, Mysore. [M.A. 7–11

Bolidenite. P. Ramdohr and O. Ödman, Neues Jahrb. Min., Abt. 1940, Beil.-Bd. 75, p. 317 (Bolidenit). Local name for falkmanite (q.v and also other ores, at the Boliden mines, north Sweden.

Brunckite. R. Herzenberg, 1938. Zentr. Min., Abt. A, 1938, p. 37 Zinc sulphide as white amorphous (gel) material from Peru. Nam after Bergrat Otto Brunck (1866–), of Freiberg, Saxony. [M.A. 7–26

Buldymite. A. S. Amelandov and K. N. Ozerov, 1934. [Min. Sy Moscow, 1934, no. 2, p. 24.] O. M. Shubnikova, Trans. Lomonosov In Acad. Sci. USSR, 1936, no. 7, p. 320 (Булдымит, Buldymite). A varie of vermiculite, $K_2O.7MgO.2FeO.3(Al,Fe)_2O_3.9SiO_2.6H_2O$. A brov scaly mineral intermediate between biotite and vermiculite; swells on heating. From corundum-plagioclase veins at Buldymsk, Sverdlov district, Ural. Named from the locality.

Caesium-spodumene. P. Quensel, 1939. Geol. För. För Stockholm, vol. 60 (for 1938), p. 625 (caesium spodumene), p. 6 (caesium-spodumene). *See* Diaspodumene. [M.A. 7–335.]

Calcio-gadolinite. T. Nakai, 1938. Bull. Chem. Soc. Japan, vol. 1 p. 591. A variety of gadolinite with rare-earths partly replaced calcium (CaO 11·91 %); from Japan. [M.A. 7–264.]

Calc-pyralmandite. L. L. Fermor, 1938. Rec. Geol. Surv. Indi vol. 73, pp. 154, 156; Indian Assoc. Cultiv. Sci., 1938, Spec. Publ. no. p. 18. *See* Gralmandite.

Carbonyl. G. Vavrinecz, 1939. Földtani Közlöny, Budapest, vol. 6 pp. 82, 98 (Carbonyl). Carbon monoxide, CO, as a natural gas. [M. 7–471.]

Čermíkite. B. Ježek, Mineralogie, Praha, 1932, (Nat. Hist., vol. 6 p. 1260 (Čermíkit); R. Rost, Bull. Internat. Acad. Sci. Bohême, 193 vol. —, preprint p. 2 (Čermíkite). The Czech spelling of tschermigi (F. Kobell, 1853), from the locality, Čermíky = Tschermig, Bohemi [M.A. 7–11.]

Chacaltaite. M. Kołaczkowska, 1936. Spraw. Tow. Nauk. Warsa (Compt. Rend. Soc. Sci. Varsovie), Cl. II, vol. 29, p. 71 (Czakaltai

22 (Chacaltaïte). A green chlorite-like mineral previously described
binite [M.A. 6–473], from which it differs in its X-ray pattern.
ned from the locality, Chacaltaya, Bolivia. [M.A. 7–226.]

herskite. B. A. Gavrusevich, 1935. Trans. Lomonosov Inst. Acad.
USSR, Ser. Min., no. 5, p. 100 (черскит); O. M. Shubnikova, ibid.,
7, no. 10, p. 223 (Черскит, Cherskite). An undescribed manganese
eral with phlogopite, diopside, &c., from Slyudyanka, Transbaikalia.

hinglusuite. V. I. Gerasimovsky, 1938. Bull. Acad. Sci. URSS,
Sci. Math. Nat., Sér. Géol., 1938, p. 153 (Чинглусуит), p. 156
inglusuite). Hydrated titano-silicate of manganese, sodium, &c.,
a,K)$_2$O.5(Mn,Ca)O.3(Ti,Zr)O$_2$.14SiO$_2$.9H$_2$O, as black amorphous
tamict) grains. Named from the locality, Chinglusuai (Чинглусуай)
r, Kola peninsula, Russia. [M.A. 7–222.]

hkalovite. V. I. Gerasimovsky, 1939. Compt. Rend. (Doklady)
d. Sci. URSS., vol. 22, p. 259 (chkalovite). Sodium and beryllium
te, $Na_2Be(SiO_3)_2$, orthorhombic, from the Kola peninsula, Russia.
ed after the polar aviator, Valery Pavlovich Chkalov. [M.A.
4.]

hrome-acmite. A. Holmes, 1937. Trans. Geol. Soc. South Africa,
39 (for 1936), p. 405. Suggested as a constituent molecule $NaCrSi_2O_6$
rome-diopside (containing Cr_2O_3 2·03, Na_2O 1·37 %) from the
berlite at Jagersfontein, Orange Free State. [M.A. 7–188.]

hrome-kyanite. K. N. Ozerov and N. A. Bykhover, 1936. Trans.
r. Geol. Prosp. Inst. USSR, no. 82, p. 72 (хром-кианит), p. 100
me cyanite). A green variety of kyanite containing chromium
O_3 1·81 %) from Yakutia, Siberia. [M.A. 7–49.]

inoscorodite. H. Strunz and K. Sztrókay, 1939. Zentr. Min.,
A, 1939, p. 277 (Klinoskorodit). A supposed monoclinic form
rphous with orthorhombic scorodite. [M.A. 7–509.]

opper-zinc-epsomite. C. Milton and W. D. Johnston, 1937.
r. Min., vol. 22, no. 12, pt. 2, p. 10; 1938, vol. 23, p. 175.

upro-asbolane. L. De Leenheer, 1938. Ann. Service Mines,
anga, vol. 8 (for 1937), p. 35 (cupro-asbolane). A cobaltiferous wad
olane) containing also copper, from Katanga, Belgian Congo.
. 7–419.]

uproauride. M. P. Lozhechkin, 1939. Compt. Rend. (Doklady)
d. Sci. URSS, vol. 24, p. 454 (cuproauride). The 'gold cupride' of

Karabash, Ural, is a mixture of Cu_3Au_2 (63 %) and $AgAu_4$. The form as a new mineral, is called cuproauride. [M.A. **7**–515.]

Cuproboulangerite. S. S. Smirnov, 1933. Trans. United Geol. Pr pecting Service USSR, no. 327, pp. 140, 284, 338 (купро-буланжери O. M. Shubnikova, Trans. Lomonosov Inst. Acad. Sci. USSR, 19 no. 10, p. 175 (Купробуланжерит, Cuproboulangerite). A cuprifero variety of boulangerite from Transbaikalia.

Cuprocopiapite. M. C. Bandy, 1938. Amer. Min., vol. 23, p. 73 L. G. Berry, ibid., 1939, vol. 24, p. 182. A variety of copiapite conta ing 6 % CuO, from Chile. [M.A. **7**–223.]

Cuprojarošite. J. Kokta, 1937. Sborník Klubu Přírodovědecké v Brně, vol. 19 (for 1936), p. 76 (Kuprojarošit). A variety of melanter containing copper (CuO 4·40 %) and magnesium (MgO 4·29 %). S Jarošite. [M.A. **7**–316.]

Cuprokirovite. G. N. Vertushkov, 1939. Bull. Acad. Sci. URS Sér. Géol., 1939, no. 1, p. 109 (купрокировит), p. 114 (cuprokirovit A variety of melanterite containing MgO 3·36 % and CuO 3·18 (Fe,Mg,Cu)SO_4.7H_2O, resulting from underground fires in the Kala mine, Kirovgrad, Ural. Named after Mr. S. M. Kirov (С. М. Киро *See* Kirovite. [M.A. **7**–418.]

Cuprorivaite. C. Minguzzi, 1938. Periodico Min. Roma, vol. p. 333 (cuprorivaite); Atti X Congr. Internaz. Chim. Roma, 1938, vol. p. 725; Chimica e Industria, Milano, 1938, vol. 20, p. 278. Hydro silicate of copper, calcium, aluminium, and sodium, as small blue grai from Vesuvius. Named from a supposed relation to rivaite (6th Lis [M.A. **7**–225, 470.]

Czakaltait. Polish form of Chacaltaite (q.v.).

Devadite. L. L. Fermor, 1938. Proc. Nat. Inst. Sci. India, vol. p. 275. A hypothetical mineral, 5Mn_3O_4.5Mn_2O_3.8Fe_2O_3, which breaking down gave rise to a mineral with the vredenburgite structu but containing more iron than the vredenburgite originally describe Named from the locality, Devada, Vizagapatam, Madras. *See* Garividi [M.A. **7**–169.]

Diaspodumene. P. Quensel, 1939. Geol. För. Förh. Stockhol vol. 60 (for 1938), p. 626 (diaspodumene, caesium diaspodume caesium-diaspodumene). A symplektic intergrowth of normal spod mene and a hypothetical caesium-spodumene. [M.A. **7**–335.]

isenpickeringit. H. Meixner and W. Pillewizer, 1937. Zentr. .., Abt. A, 1937, p. 266 (Eisenpickingerit [*sic*]). Pickeringite con- ing some iron replacing magnesium. Synonym of Ferropickeringite .). *See* Mangan-pickeringite. [M.A. **7**–12.]

llestadite. D. McConnell, 1937. Amer. Min., vol. 22, p. 977. An -member of the apatite group resembling wilkeite in which P_2O_5 is aced by SO_3 (20·69) and SiO_2 (17·31 %). From Crestmore, Cali- ia. Named after Dr. R. B. Ellestad, of the University of Minnesota. A. **7**–14, 88, 475.]

ndothermite. D. S. Belyankin, 1938. *See* Monothermite.

rnite. — Franck, 1911. [Rev. Asoc. Rural Uruguay, Montevideo, l, p. 88 (Ernita).] H. Himmel, Zentr. Min., Abt. A, 1938, p. 243 nita). A supposed new mineral from Uruguay, later identified with ssular. Named after the author's wife. [M.A. **7**–317.]

alkmanite. P. Ramdohr and O. Ödman, 1940. Neues Jahrb. ., Abt. A., Beil.-Bd. 75, p. 315 (Falkmanit). J. E. Hiller, Zeits. st., 1939, vol. 102, p. 138. Sulphantimonite of lead, $3PbS.Sb_2S_3$, as ular monoclinic crystals. Named after Oscar Carl August Falkman 7–), director of the Boliden mines in north Sweden, one of the ities where the mineral was found. It had previously been known lly as bolidenite. [M.A. **7**–468, 513.]

erantigorite. E. S. Simpson, 1937. Journ. Roy. Soc. W. Australia, 23, p. 22. A contraction of ferro-antigorite (11th List).

erribiotite. H. Meixner, 1939. Fortschr. Min. Krist. Petr., vol. 23, liv (Ferribiotite, *pl.*). F. Angel and A. Marchet, ibid., p. xxxviii rri-Biotite, *pl.*). Biotite rich in ferric iron.

erricopiapite. L. G. Berry, 1938. Amer. Min., vol. 23, no. 12, 2, p. 3; 1939, vol. 24, p. 182. A variety of copiapite in which X in the nula $X(OH)_2.Fe'''_4(SO_4)_6.nH_2O$ is mainly ferric iron. Similarly, ocopiapite and magnesiocopiapite when X is mainly ferrous iron or gnesium.

errigarnierite. E. F. Alekseeva and M. N. Godlevsky, 1937. n. Soc. Russe Min., ser. 2, vol. 66, p. 99 (ферригарниерит). Gar- ite containing 5·34 % Fe_2O_3, from Novo-Cheremshansky, Ural. A. **7**–214.]

errigedrite. D. P. Serdyuchenko, 1936. Bull. Acad. Sci. URSS, Sci. Math. Nat., Sér. Géol., 1936, p. 693 (ферригедрит), p. 696

(ferrihedrite [*sic*]). An orthorhombic amphibole analogous to gedri with Fe_2O_3 in place of Al_2O_3. [M.A. **7**–10.]

Ferriglaucophane. M. B. Ramachandra Rao, 1939. Rec. Mys Geol. Dept., vol. 37, p. 68 (ferriglaucophane), p. 77 (ferri glaucophan Intermediate in composition between glaucophane and riebecki [M.A. **7**–470.]

Ferripyroaurite. H. Meixner, 1937. *See* Ferropyroaurite.

Ferriwotanite. H. Meixner, 1939. Fortschr. Min. Krist. Pe vol. 23, p. xliv (Ferriwotanite = Ferrititanbiotite, *pl.*). F. Angel a A. Marchet, ibid., p. xxxvii (Ferri-Wotanit). Biotite rich in ferric ir and titanium. (Cf. wodanite, 9th List; wotanite, 14th List.)

Ferrocopiapite. L. G. Berry, 1938. *See* Ferricopiapite.

Ferroepsomite. G. N. Vertushkov, 1939. Bull. Acad. Sci. URS Sér. Géol., 1939, no. 1, p. 110 (ферроэпсомит), p. 115 (ferroepsomit A variety of epsomite containing up to 30 % of the tauriscite [orth rhombic $FeSO_4.7H_2O$] molecule. [M.A. **7**–418.]

Ferrogedrite. C. E. Tilley, 1939. Geol. Mag. London, vol. 76, p. 3 An aluminous orthorhombic amphibole (gedrite) rich in ferrous ir Compare ferroanthophyllite (9th List).

Ferrohortonolite. W. A. Deer and L. R. Wager, 1939. Amer. Mi vol. 24, p. 25. Members of the olivine group containing 70–90 mol. % Fe_2SiO_4. [M.A. **7**–447.]

Ferrohumite. N. K. Skakovsky, 1929. [Min. Syre, Moscow, no. p. 913.] O. M. Shubnikova, Trans. Lomonosov Inst. Acad. Sci. USS 1937, no. 10, p. 138 (Феррогумит, Ferrohumite). Humite contain FeO 44·47 % from Sadon mine, northern Caucasus. This mineral w later referred to knebelite by L. A. Vardanyantz, 1934 [M.A. **6**–426]

Ferromontmorillonite. I. I. Ginzburg, 1939. Bull. Acad. S URSS, Sér. Géol., 1939, no. 1, p. 85 (ферромонтмориллонит), p. (ferromontmorillonite). Synonym of nontronite.

Ferropickeringite. G. N. Vertushkov, 1939. Bull. Acad. S URSS, Sér. Géol., 1939, no. 1, p. 110 (ферропиккерингит), p. (ferropickeringite). A variety of pickeringite containing up to 30 % of halotrichite molecule. Synonym of Eisenpickeringit (q.v.). [M.A. **7**–4

erroplumbite. Chem. Abstr. (Amer. Chem. Soc.), 1925, vol. 19, 621. Error for Plumboferrite (L. J. Igleström, 1881; A. Aminoff, [M.A. 4–89]).

erropyroaurite, ferripyroaurite. H. Meixner, 1937. Zentr. Min., A, 1937, p. 370 (Ferropyroaurit, Ferripyroaurit). The white enbrucite' of F. Sandberger, 1880, from Siebenlehn, Saxony, belongs the hydrotalcite group and is called ferropyroaurite, $MgCO_3$. $OH)_2.5Mg(OH)_2.4H_2O$. On oxidation this passes to gold-yellow or n ferripyroaurite, $MgCO_3.2Fe(OH)_3.5Mg(OH)_2.4H_2O$. [M.A. 7–218.]

errostilpnomelane. C. O. Hutton, 1938, Min. Mag., vol. 25, 72, 177. To replace the name stilpnomelane for hydrated silicate rous iron, &c.; the latter name being transferred to the correspond- ric compound. [The name stilpnomelane was, however, originally ed to the dark-green ferrous silicate, which on oxidation passes to rown ferric silicate, chalcodite.]

errotine. P. Sasima in O. M. Shubnikova, Trans. Lomonsov Inst. Sci. USSR, Ser. Min., 1937, no. 10, p. 223 (Ферротин, Ferrotine). ndetermined iron oxide, Fe_nO_{n+1} (FeO 61·30, Fe_2O_3 33·20 %), as grey, strongly magnetic scales and spherules from the Ayata river, tary of the Yenesei, Siberia.

uor-tremolite. D. P. Grigoriev, 1939. Compt. Rend. (Doklady) Sci. URSS, vol. 23, p. 71 (fluore-tremolite). Artificially produced olite containing fluorine (9·03 %) in place of hydroxyl. [M.A. 7.]

shallassite. P. N. Chirvinsky, 1936. V. I. Vernadsky jubilee ne, Acad. Sci. USSR, 1936, vol. 2, p. 757 (Фошалласит), p. 763 hallasit); A. E. Fersman and E. M. Bonshtedt, Minerals of the ina and Lovozero tundras, 1937, p. 90 (foshallasite). Hydrated um silicate, $3CaO.2SiO_2.3H_2O$, from the Kola peninsula, Russia. ed to foshagite and centrallassite and named from a combination ese names. [M.A. 7–10.]

rividite. L. L. Fermor, 1938. Proc. Nat. Inst. Sci. India, vol. 4, 7. A hypothetical mineral, $3Mn_3O_4.2Fe_2O_3$, which on breaking gave rise to vredenburgite (5th List; a lamellar intergrowth of nannite and jacobsite with excess MnO_2). Named from the locality, idi, Vizagapatam, Madras. *See* Devadite. [M.A. 7–169.]

Gedroitzite. I. N. Antipov-Karataiev and I. D. Sedletzky, 19
Compt. Rend. (Doklady) Acad. Sci. URSS, n. ser., vol. 17, p. 2
(gedroitsite). I. D. Sedletzky, ibid., 1939, vol. 23, p. 565 (gedroizit
1940, vol. 26, p. 241 (gedroitzite). An artificial hydrous alumino-silic
of sodium, $Na_2O.Al_2O_3.3SiO_2.2H_2O$, related to permutite, later identif
as a constituent of alkali soil from Ukraine. Named after Konstan
Kaetonovich Gedroitz (Константин Каетонович Гедройц) (1872–193
professor of pedology in the Forestry Institute of Leningrad. [M
7–60, 515.]

Gelosite. J. A. Dulhunty, 1939. Journ. Roy. Soc. New South Wal
vol. 72, p. 184. Various undetermined microscopical constituents
torbanite from New South Wales are named gelosite, retinosite, humosi
and matrosite. [M.A. 7–370.]

Gepherite. I. D. Sedletzky, Compt. Rend. (Doklady) Acad. S
URSS, 1940, vol. 26, p. 241. Gepherite = гёферит = hoeferite (1st Lis

Giesenherrite. D. P. Grigoriev, Mém. Soc. Russe Min., 1937, ser
vol. 66, p. 264 (*гизингеерит*), p. 300 (*giesenherrite*). Mis-spelling
hisingerite (J. J. Berzelius, 1828), named after Wilhelm Hisin
(1766–1852). Quoted as an example of the many errors that a
through double transliteration.

Goeschwitzite. I. D. Sedletzky, 1940. Compt. Rend. (Dokla
Acad. Sci. URSS, vol. 26, p. 242 (heshvitcite!). The 'Glimmer
Goeschwitz' of E. Maegdefrau and V. Hofmann (Zeits. Krist., 19
vol. 98, p. 33), a micaceous clay from Goeschwitz (Göschwitz), Thurin
Named from the locality.

Goldschmidtine. M. A. Peacock, 1937. Amer. Min., vol. 22, no.
pt. 2, p. 11 (abstract); ibid., 1938, vol. 23, p. 176; 1939, vol. 24, p. 2
1940, vol. 25, p. 372. Described as silver antimonide, Ag_2Sb, but l
identified with stephanite (Ag_5SbS_4). [M.A. 7–15, 317, 516.]

Gralmandite. L. L. Fermor, 1938. Rec. Geol. Surv. India, vol.
pp. 154, 156; Indian Assoc. Cultiv. Sci., 1938, Spec. Publ. no. 6, p.
Garnets intermediate in composition between grossular and almandi
Varieties containing in addition less than 10 % of the pyrope
spessartine molecules are called magnesia-gralmandite and mangan
gralmandite. Compare spandite (4th List), grandite (5th List),
calc-spessartite (11th List).

Gratonite. C. Palache and D. J. Fisher, 1939. Amer. Min., vol.
p. 136; 1940, vol. 25, p. 255. Sulpharsenite of lead, $Pb_9As_4S_{15}$

nbohedral crystals from Peru. Named after Louis Caryl Graton
)0–), Professor of Mining Geology at Harvard University. [M.A.
53, 512.]

rundite. R. E. Grim and W. F. Bradley, Journ. Amer. Ceramic
. 1939, vol. 22, p. 157; Rep. Investig. Geol. Surv. Illinois, 1939,
53, p. 5. Trade-name for a non-bentonitic clay allied to illite (q.v.),
Grundy Co., Illinois. Named from the locality. [M.A. 7–423.]

ilgardite. C. S. Hurlbut and R. E. Taylor, 1937. Amer. Min.,
22, p. 1052. Hydrated chloro-borate of calcium, $Ca_8(B_6O_{11})_3Cl_4$.
), as colourless monoclinic-domatic crystals in the rock-salt of
siana. Named in memory of Prof. Eugene Waldemar Hilgard
3–1916), who was the first to examine the salt deposits of Louisiana.
Parahilgardite. [M.A. 7–14, 217, 224, 355.]

umosite. J. A. Dulhunty, 1939. *See* Gelosite.

ydroforsterite. N. E. Efremov, 1938. Bull. Acad. Sci. URSS,
ci. Math. Nat., Sér. Géol., 1938, p. 132 (hydroforsterite); Compt.
l. (Doklady) Acad. Sci. URSS, 1939, vol. 22, p. 432 (Hydrophor-
ie!). Hydrated orthosilicate of magnesium, $Mg_2SiO_4.2H_2O$, in the
of asbestos and regarded as an end-member of the serpentine
s. [M.A. 6–490, 7–221, 370.]

ydrogedroitzite. I. D. Sedletzky, 1940. Compt. Rend. (Doklady)
l. Sci. URSS, vol. 26, p. 241 (Hydrogedroitzite). A hypothetical,
ated, metastable form of gedroitzite (q.v.). Similarly, Hydro-
tmorillonite, Hydronontronite, and Hydropyrophyllite, correspond-
o montmorillonite, &c.

ydrohalloysite. I. D. Sedletzky, 1940. Compt. Rend. (Doklady)
l. Sci. URSS, vol. 26, p. 241 (Hydrohalloysite). 'Hydrated halloy-
, $Al_2O_3.2SiO_2.4H_2O$, of S. B. Hendricks (Amer. Min. 1938, vol. 23,
95). [M.A. 7–422.]

ydrokaolin. D. S. Belyankin and V. P. Ivanova, 1935. Zentr.
, Abt. A, 1935, p. 298 (Hydrokaolin). Synonym of halloysite, which
nsidered to differ from kaolin only in its degree of hydration.
. 7–103.]

ydromagniolite. N. E. Efremov, 1939. Compt. Rend. (Doklady)
l. Sci. URSS, vol. 24, p. 287 (hydromagniolites). A collective name
ydrated silicates of magnesium. [M.A. 7–419.]

Hydrosialite. N. E. Efremov, 1939. Compt. Rend. (Dokla Acad. Sci. URSS, vol. 24, p. 287 (hydrosyalites). A collective name hydrated silicates of aluminium or clay minerals. *See* Sialite. [M 7–419.]

Hydrotenorite. L. De Leenheer, 1937. Bull. Soc. Belge Gé vol. 47, p. 215 (hydroténorite); ibid., 1938, vol. 48, p. 343. An am phous black mineral (pitchy copper ore) from Katanga; deducti chrysocolla, the formula is given as $4CuO{\cdot}H_2O$. V. Billiet and A. V dendriessche, Bull. Soc. Belge, Géol., 1938, vol. 48, p. 333, prove identity with tenorite. [M.A. 7–10, 226.]

Hydrothionite. G. Vavrinecz, 1939. Földtani Közlöny, Budap vol. 69, pp. 82, 98 (Hydrothionit). Hydrogen sulphide, H_2S, as a natu gas. Named from *ὕδωρ*, water, and *θεῖον*, sulphur. [M.A. 7–471.]

Hydroxylapatite. P. Niggli, Lehrbuch der Mineralogie, 2nd ed 1926, p. 393 (Hydroxylapatit); A. N. Winchell, 1927, Elements optical mineralogy, 2nd edit., 1927, pt. 2, p. 128 (Hydroxylapati Variant of hydroxyapatite (6th List), $3Ca_3P_2O_8.Ca(OH)_2$.

Illite. R. E. Grim, R. H. Bray, and W. F. Bradley, 1937. Am Min., vol. 22, p. 816. A general term for a micaceous constituent argillaceous sediments, in particles usually less than a micron acr with the approximate formula $2K_2O.3(Mg,Fe)O.8(Al,Fe)_2O_3.24Si$ $12H_2O$. Named from the State of Illinois. (Compare pholidoide a phyllite, 14th List.) [M.A. 7–13, 422.]

Ilmeno-corundum. J. de Lapparent, 1937. Min. Petr. M (Tschermak), vol. 49, p. 15 (ilméno-corindon, corindon ferro-titan Corundum in the emery of Samos, previously called taosite (14th Li but not analysed. [M.A. 7–150.]

Inderite. A. M. Boldyreva and E. N. Egerova, 1937. [Mat. Centr. Geol. Prosp. Inst. USSR, General Ser., no. 2.] A. M. Boldyreva, M Soc. Russe Min., 1937, ser. 2, vol. 66, p. 651 (Индерит), p. 672 (Inderit M. N. Godlevsky, ibid., pp. 327, 355. O. M. Shubnikova, Trans. Lo nosov Inst. Acad. Sci. USSR, 1937, no. 10, p. 216. G. B. Boky, B Acad. Sci. URSS, Cl. Sci. Mat. Nat., Ser. Chim., 1937, p. 881 (Индер p. 883 (Inderite). Hydrated magnesium borate, $2MgO.3B_2O_3.15H_2O$ nodular aggregates of acicular crystals (pseudo-orthorhombic). Nam from the locality, Inder (Индер), Kazakhstan, S.W. Siberia. [M 7–131–3, 476.]

on-albite. G. F. Faust, 1936. Amer. Min., vol. 21, p. 762 (Iron-e). The compound $NaFeSi_3O_8$ with Fe‴ in place of Al in albite. arly, Iron-anorthite and Iron-microcline. Compare Iron-ortho-(11th List). [M.A. **7**–145.]

on-anorthite. G. F. Faust, 1936. *See* Iron-albite.

on-chlorite. A. F. Hallimond, 1939. Min. Mag., vol. 25, p. 442 chlorites). Translation of Eisenchlorite (*pl.*) of J. Holzner, Neues . Min., Abt. A, 1938, Beil.-Bd. 73, p. 389. A group name to include us chloritic minerals rich in iron. Eisenchlorit of C. F. Naumann, was applied only to delessite.

on-hornblende. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido , Ser. 4, vol. 4, p. 421 (ironhornblende). A green hornblende with 17·09, Fe_2O_3 8·05 %.

on-knebelite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido , Ser. 4, vol. 4, p. 403 (Ironknebelite). The same as järnknebelit, knebelit (M. Weibull, 1884) and igleströmite (M. Weibull, 1883). ntermediate member (Fe_2SiO_4 60–80 mol. %) of the fayalite-oite series, near to knebelite.

on-microcline. G. F. Faust, 1936. *See* Iron-albite.

on-serpentine. J. W. Gruner, 1936. Amer. Min., vol. 21, p. 453 serpentine). The hypothetical molecule $H_4Fe_3Si_2O_9$ with Fe in of Mg in serpentine. Compare Iron-antigorite (11th List), Ferro-otile (14th List). [M.A. **6**–480.]

on-tephroite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido , Ser. 4, vol. 4, p. 406 (Irontephroite). An intermediate member iO_4 5–20 mol. %) of the fayalite-tephroite series.

nowaite. C. Hintze, Handbuch Min., Ergänzungsband, 1937, (Janowait). A more correct spelling of janite (13th List), from nowa valley, Poland. On p. 741 another spelling—Yanit.

rošite. J. Kokta, 1937. Sborník Klubu Přírodovědeckého v Brné, 9 (for 1936), p. 75 (Jarošit). A variety of melanterite containing 5·55 %, from Slovakia. Named after Zdeněk Jaroš, keeper of als in the museum at Brno. Pronounced Jaroschit, yarroshite. to be confused with jarosite from the Jaroso ravine, Spain.] *See* jarošite and Kirovite. [M.A. **7**–316.]

Jelinite. J. D. Buddhue, 1938. Mineralogist, Portland, Oreg vol. 6, no. 9, p. 9 (jelinekite, preferably jelinite). To replace the na kansasite (q.v.). Named after Mr. George Jelinek, of Ellsworth, Kans who found the material. [M.A. **7**–265.]

Kali-magnesio-katophorite. R. T. Prider, 1939. Min. Ma vol. 25, p. 378. *See* Magnophorite.

Kalisaponite. P. N. Chirvinsky, 1939. Bull. Acad. Sci. URSS, S Géol., 1939, no. 4, p. 32 (калисапонит), p. 43 (kalisaponite). A zeoli mineral resembling saponite in appearance, containing K_2O 6·57 % formula $(R_2O,RO).Al_2O_3.5SiO_2.3H_2O$. [M.A. **7**–515.]

Kansasite. J. D. Buddhue, 1938. Mineralogist, Portland, Oreg vol. 6, no. 1, p. 8. A fossil resin from Kansas, afterwards named jelin (q.v.). [M.A. **7**–265.]

Karachaite. N. E. Efremov, 1936. Bull. Acad. Sci. URSS, Cl. S Math. Nat., Sér. Géol., 1936, p. 921 (Карачаит), p. 927 (karachait An asbestiform variety of chrysotile-serpentine with the composit $MgO.SiO_2.H_2O$. Named from the locality, Karachai, Caucasus. [M. **9**–9, 370.]

Khibinite. Chem. Abstr. (Amer. Chem. Soc.), 1935, vol. 29, p. 47 Amer. Min., 1936, vol. 21, p. 269. Erroneously given as a mineral, rat than a rock, name. Chibinit (W. Ramsay, 1899) = Хибинит = Khi nite is a pegmatitic nepheline-syenite with eudialyte, &c., from Khibina tundra, Kola peninsula. [M.A. **6**–307, 310, 420; **7**–196.]

Khoharite. L. L. Fermor, 1938. Rec. Geol. Surv. India, vol. p. 145; Indian Assoc. Cultiv. Sci., 1938, Spec. Publ. no. 6, p. 8. T hypothetical garnet molecule $3MgO.Fe_2O_3.3SiO_2$. Named from Khohar meteorite (India, fell 1910), it being suggested that such garnet was the original material of enstatite chondrules. [M.A. **7**–16

Kirovite. G. N. Vertushkov, 1939. Bull. Acad. Sci. URSS, Sér. Gé 1939, no. 1, p. 109 (кировит), p. 114 (kirovite). A variety of melanteri containing MgO 7·45 %, $(Fe,Mg)SO_4.7H_2O$, resulting from undergrou fires in the Kalata mine, Kirovgrad, Ural. Named after Mr. S. Kirov (С. М. Киров). *See* Cuprokirovite and Jarošite. [M.A. **7**–418.]

Kolskite. N. E. Efremov, 1939. Compt. Rend. (Doklady) Ac Sci. URSS, vol. 22, p. 433 (kolskite). V. A. Afanasiev, ibid., 1939, vol. p. 516. A serpentine mineral with the composition $5MgO.4SiO_2.4H$

the Kola peninsula, Russia. Named from the locality. [M.A. 0.]

otoite. T. Watanabe, 1939. Min. Petr. Mitt. (Tschermak), vol. 50, 1; Fortschr. Min. Krist. Petr., vol. 23, p. clxvi (Kotoit). Magne- borate, $Mg_3B_2O_6$, occurring abundantly as a granular (ortho- bic) constituent of dolomitic marble in Korea. Named after Pro- r Bundjirô Kotô (1856–1935), Japanese geologist. [M.A. **7**–315.]

atochvilite. R. Rost, 1937. [Rozpravy České Akad.]; Bull. nat. Acad. Sci. Bohême, 1937, vol. —, preprint, p. 6 (Kratochvílite). rganic compound $C_{13}H_{10}$, fluorene (14th List), formed by burning ritous shale in Bohemia. Named after Prof. Josef Kratochvíl, of Karlovy University, Praha. [M.A. **7**–11.]

ightonite. C. Palache, 1938. Amer. Min., vol. 23, p. 34; M. C. y, ibid., p. 719. A trimetal sulphate, $K_2Ca_2Cu(SO_4)_4.2H_2O$, as blue triclinic (pseudo-orthorhombic) crystals from Chile. Named Dr. Tomas Leighton, Professor of Mineralogy in the University ntiago, Chile. [M.A. **7**–59, 223.]

mnäsite. G. Pehrman, 1939. Acta Acad. Aboensis, Math. et ica, vol. 12, no. 6, p. 12 (Lemnäsit). Phosphate of manganese, sodium, and calcium, $3R_3(PO_4)_2.2NaOH$, as black masses, probably oclinic, from Lemnäs, Kimito, Finland. Named from the locality. **7**–418.]

thium-muscovite. R. E. Stevens, 1938. Amer. Min., vol. 23, 608, 523 (lithium muscovite). A hypothetical molecule $_6Al_6Al_4Si_{12}O_{40}(F,OH)_8$ for expressing the composition of lepidolite. **7**–353.]

pezite. M. C. Bandy, 1937. Amer. Min., vol. 22, p. 929. Potassium romate, $K_2Cr_2O_7$, as minute orange-red balls in the soda-nitre of . Named after Dr. Emiliano Lopez, of Iquique. [M.A. 7–13.]

ovozerite. V. I. Gerasimovsky, 1939. Compt. Rend. (Doklady) l. Sci. URSS, vol. 25, p. 753. Hydrous silicate of zirconium, &c., $.RO.ZrO_2.6SiO_2.3H_2O$, as black or pink, optically uniaxial grains e alkalic rocks of Lovozero, Kola peninsula. Differs from eudialyte ntaining less alkalis and more water. Named from locality. [M.A. 8.]

ussatine. F. Laves, 1939. Naturwiss., vol. 27, p. 706 (Lussatin). rm of silica consisting of cryptocrystalline cristobalite as fibres with

optically negative elongation, distinct from lussatite with positi elongation, corresponding respectively to the pair chalcedony a quartzine of cryptocrystalline fibrous quartz. [M.A. **7**–514.]

Magallanite. G. A. Fester, J. Cruellas, and F. Gargatagli, 19 Anal. Soc. Cient. Argentina, vol. 124, p. 211 (magallanita). A ha asphaltum thrown up by the sea on the coast of Magallanes (Magalla South America. Named from the locality. [M.A. **7**–124.]

Magnesia-goslarite. C. Milton and W. D. Johnston, 1937. Am Min., vol. 22, no. 12, pt. 2, p. 10; 1938, vol. 23, p. 175.

Magnesia-gralmandite. L. L. Fermor, 1938. *See* Gralmandite.

Magnesiocopiapite. L. G. Berry, 1938. *See* Ferricopiapite.

Magnesio-cummingtonite. C. E. Tilley, 1939. Geol. Mag. Londo vol. 76, p. 330. A Mg-Fe monoclinic amphibole, with MgO in excess FeO, corresponding to the iron member grunerite.

Magnesium-apjohnite. H. Meixner and W. Pillewizer, 19 Zentr. Min., Abt. A, 1937, p. 265 (Magnesiumapjohnit). Apjohnite w some magnesium replacing manganese. Synonym of bushman (= bosjemanite). [M.A. **7**–12.]

Magnesium-beidellite. G. Nagelschmidt, 1938. Min Mag., vol. p. 141. A clay mineral with the composition $Mg_3Si_4O_{11}.nH_2O$, regard as an end-member of the montmorillonite group.

Magnesium-bentonite. F. A. Bannister, 1939. Ann. Rep. Che Soc., vol. 35 (for 1938), p. 191 (magnesium-bentonite). Described W. F. Foshag and A. O. Woodford in 1936 [M.A. **6**–372] as 'bentoni magnesian clay-mineral from California' with the formula $7MgO.10Si$ $5H_2O$ or $2MgO.3SiO_2.3H_2O$.

Magnesium-halotrichite. H. Meixner and W. Pillewizer, 19 Zentr. Min., Abt. A, 1937, p. 266 (Magnesiumhalotrichit). Halotrich with MgO in place of FeO. [M.A. **7**–12.]

Magnophorite. R. T. Prider, 1939. Min. Mag., vol. 25, pp. 373, 3 An alkalic amphibole in leucite-rich rocks from Western Austral allied to katophorite but rich in potassium and magnesium and describ as kali-magnesio-katophorite, this term being contracted to magn phorite. It had earlier been named simpsonite (q.v.).

angan-actinolite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido ., Ser. 4, vol. 4, p. 424 (Manganactinolite). A variety of actinolite ining MnO 5·79 %.

anganese-gralmandite. L. L. Fermor, 1938. *See* Gralmandite.

angan-knebelite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido ., Ser. 4, vol. 4, p. 405 (Manganknebelite). An intermediate ber (Fe_2SiO_4 20–40 mol. %) of the fayalite-tephroite series, near ebelite.

anganophyllite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido ., Ser. 4, vol. 4, p. 430 (Manganophyllite). The hypothetical ule $H_4K_2Mn_5Al_4Si_5O_{24}$, corresponding to siderophyllite, to explain mposition of biotite. Not the manganophyll, manganophyllite of Iglesström (1872).

angan-phlogopite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido . Ser. 4, vol. 4, p. 431 (Manganphlogopite). A variety of phlogopite ining MnO 18·24 %.

ngan-pickeringite. H. Meixner and W. Pillewizer, 1937. Zentr. Abt. A, 1937, p. 265 (Manganpickingerit [*sic*]). Pickeringite con- g some manganese replacing magnesium. *See* Magnesium-ap- e. [M.A. 7–12.]

ngan-tremolite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido . Ser. 4, vol. 4, p. 425 (Mangantremolite). A variety of tremolite ning MnO 7·38 %.

nganvoelckerite. P. Quensel, 1937. Geol. För. Förh. Stock- vol. 59, p. 161 (manganvoelckerite). Manganapatite with fluorine replaced by oxygen, $3(Ca,Mn)_3(PO_4)_2.(Ca,Mn)(O,F_2)$. [M.A.

scareignite. A Lacroix, 1936. Le volcan actif de l'île de la on, Paris, 1936, p. 248 (mascareignite). A form of opaline silica 13·61 %) of vegetable origin consisting largely of the siliceous s of grasses with some diatoms; from Reunion, Indian Ocean. l from the Mascarene Islands (*Fr.*, Mascareignes), including on (= Mascarenhas = Bourbon), said to have been discovered 3 by the Portuguese navigator, Pedro Mascarenhas. [M.A. 7–2.]

trosite. J. A. Dulhunty, 1939. *See* Gelosite.

Mesoenstatite. E. Thilo and G. Rogge, 1939. Ber. Deutsch. Che Gesell., Abt. B, vol. 72, p. 352 (Mesoenstatit). E. Thilo, Forschung und Fortschritte, 1939, vol. 15, p. 171. An enantiotropic modificati of $MgSiO_3$ stable between 900° and 1270° C. Enstatite ⇌ mesoenstat (900°) ⇌ clinoenstatite (1270°). [M.A. **7**–410.]

Metahohmannite. M. C. Bandy, 1938. Amer. Min., vol. 23, p. 7 Hydrated basic ferric sulphate, $Fe_2(SO_4)_2(OH)_2.3H_2O$, as an oran coloured powder from the partial dehydration of hohmannite, fr Chile. [M.A. **7**–223.]

Metakamacite. E. A. Owen, 1940. Phil. Mag., ser. 7, vol. 29, p. 5 Nickel-iron of the metastable α_2-form occurring as the granular ples in meteorites, as distinct from the plessite consisting of fine crystals kamacite and taenite. [M.A. **7**–538.]

Metasideronatrite. M. C. Bandy, 1938. Amer. Min., vol. 23, p. 7 Hydrated basic sulphate of sodium and ferric iron, $Na_4Fe_2(SO_4)_4(OH$ $3H_2O$, as yellow, fibrous, orthorhombic crystals from Chile. A par dehydrated form of sideronatrite. [M.A. **7**–223.]

Metasimpsonite. E. S. Simpson, 1938. Rep. Dept. Mines West Australia, for 1937, p. 88 (Metasimpsonite). L. E. R. Taylor, Jou Roy. Soc. Western Australia, 1939, vol. 25 (for 1938–9), p. (meta-simpsonite). An alteration product of simpsonite (q.v.), la identified with microlite.

Metatalc. E. Thilo, 1937. Ber. Deutsch. Chem. Gesell., Abt. vol. 70, p. 2373 (Metatalk). A modification of magnesium metasilica $MgSiO_3$, with crystal-structure different from that of enstatite clinoenstatite, obtained by dehydrating talc. [M.A. **7**–410.]

Meta-zircon. J. Lietz, 1937. Zeits. Krist., vol. 98, p. 209 (Me Zircon). Zircon of medium density consisting of normal crystal material with amorphous material. [M.A. **7**–131.]

Mitridatite. P. A. Dvoichenko, 1914. [Zap. Krym. Obshch. (Bull. Soc. Nat. Crimée), vol. 4, p. 114.] O. M. Shubnikova, Tra Lomonosov Inst. Acad. Sci. USSR, 1936, no. 7, p. 327; F. V. Chukh ibid., 1937, no. 10, p. 139 (митридатит), p. 148 (mitridatite). Hydra phosphate of calcium and ferric iron, $3CaO.2Fe_2O_3.2P_2O_5.5H_2O.naq$ earthy yellowish-green nodules and veinlets in iron ore in the Ke peninsula, Crimea. Named from the hill of Mithridat at Kerch, wh

called after Mithridates or Mithradates VI (died *c.* 63 B.C.), king of us. [M.A. **7**–60.]

ofettite. G. Vavrinecz, 1939. Földtani Közlöny, Budapest, 69, pp. 82, 98 (Mofettit). Carbon dioxide, CO_2, as a natural gas. ed from *mofeta* (Span.), mephitis, noxious emanation; and *mofetta* .), the fissure from which the gas, mainly CO_2, escapes. [M.A. 1.]

onothermite. D. S. Belyankin and V. P. Ivanova, 1936. Vernad- jubilee volume, vol. 1, p. 561 (монотермит), p. 562 (Monothermit). . Belyankin, Compt. Rend. (Doklady) Acad. Sci. URSS, 1938, 18, p. 673 (monothermite), p. 674 (monothermite or endothermite). ely scaly clay mineral, $0{\cdot}2K_2O.Al_2O_3.3SiO_2.1{\cdot}5H_2O+0{\cdot}5aq$, differ- rom kaolin in showing only one thermal effect on the heating curve, an endothermal effect at 550° and no exothermal effect at 900– C. [M.A. **7**–170.]

ontgomeryite. E. S. Larsen, 3rd, 1940. Amer. Min., vol. 25, p. 315. ous phosphate of calcium and aluminium, $Ca_4Al_5(PO_4)_6(OH)_5$. O, as green to colourless monoclinic crystals in variscite nodules Utah. Named after Mr. Arthur Montgomery, of New York City. . **7**–513.]

schellandsbergite. H. Berman and G. A. Harcourt, 1938. . Min., vol. 23, p. 764. The body-centred cubic γ-phase of silver- gam, Ag_2Hg_3 (Hg 73 %), as distinct from the face-centred cubic se of mercurial silver (var. arquerite). Named from the locality, hellandsberg, Rhenish Bavaria. [M.A. **7**–224.]

ussolinite. A. Serra, 1936. [Osservazioni sul giacimento «Oran- » in provincia di Nuoro (Sardegna), Studi Sassaresi, vol. 14, p. 5], dico Min. Roma, 1937, vol. 8, p. 88 (Mussolinite). A variety of talc Sardinia. Presumably named after Signor Benito Mussolini 3–).

yrmeki-perthitoid. P. Quensel, 1939. *See* Perthitoid.

eo-Permutit. Zeits. Krist., 1937, vol. 98, pp. 33–34. Trade-name e Permutit Company for glauconite used as a water softener.

ckel-olivine. D. P. Grigoriev, 1937. Bull. Soc. Nat. Moscou, 45, (Sect. Géol., vol. 15), p. 152 (никелевый оливин), p. 153 el olivine). Artificial crystals of nickel orthosilicate, Ni_2SiO_4. . **7**–142.]

Orlandinite. F. Ahlfeld and J. Muñoz Reyes, Mineralogie v Bolivien, 1938, p. 31. Local name for a lead-grey compact ore abunda in the Porvenir mine, Huanuni, Bolivia. It is presumably boulangeri

Orthoriebeckite. K. Willmann, 1937. Neues Jahrb. Min., Abt. Beil.-Bd. 72, p. 390 (Orthoriebeckit). The darkest coloured and le birefringent member of the riebeckite-laneite series, i.e. riebeck proper.

Overite. E. S. Larsen, 3rd, 1938. Amer. Min., vol. 23, no. 12, pt. p. 9; 1939, vol. 24, p. 188; 1940, vol. 25, p. 315. Hydrous phosphate calcium and aluminium, $Ca_3Al_8(PO_4)_8(OH)_6.15H_2O$, as pale green colourless orthorhombic crystals in variscite nodules from Utah. Nam after Mr. Edwin Over, of Colorado Springs, Colorado. [M.A. **7**–224, 51

Oxidapatite. A. N. Winchell, Elements of optical mineralo 2nd edit., 1927, p. 128 (oxidapatite). Variant of oxy-apatite (6th Lis synonym of voelckerite (6th List), $3Ca_3P_2O_8.CaO$.

Palladium-amalgam. J. B. Harrison, 1925. Official Gazet British Guiana, no. 71; Min. Mag., 1928, vol. 21, p. 398 (palladi amalgam). A. Cissarz, Zeits. Krist., 1930, vol. 74, p. 510 (Palladiu amalgam). H. Berman and G. A. Harcourt, Amer. Min., 1938, vol. p. 764 (Palladium-Amalgam). Synonym of potarite (11th Lis [M.A. **3**–4, **7**–224.]

Parabutlerite. M. C. Bandy, 1938. Amer. Min., vol. 23, p. 7 Hydrated basic ferric sulphate, $Fe(SO_4)(OH).2H_2O$, orange-colour orthorhombic, as an alteration product of copiapite, from Ch Dimorphous with butlerite (11th List). [M.A. **7**–223.]

Paradeweylite. N. E. Efremov, 1939. Compt. Rend. (Dokla Acad. Sci. URSS, vol. 22, p. 423 (paradeveilite). A hypotheti hydrated silicate of magnesium, $4MgO.3SiO_2.3H_2O$, differing fr deweylite in containing less water. [M.A. **7**–370.]

Parahilgardite. C. S. Hurlbut, 1938. Amer. Min., vol. 23, p. 7 Triclinic-pedial crystals dimorphous with hilgardite (q.v.). [M **7**–224, 355.]

Pararammelsbergite. M. A. Peacock, 1939. Amer. Min., vol. no. 12, pt. 2, p. 10; 1940, vol. 25, p. 211. Material recently described rammelsbergite, $NiAs_2$, from Ontario is found to give X-ray d differing from those for rammelsbergite from Germany, and it is n named pararammelsbergite. [M.A. **7**–469, 507.]

ercivalite. S. Weidman, 1907. Bull. Wisconsin Geol. Nat. Hist. .., no. 16, p. 283 (Percivalite). A green soda-pyroxene intergrown blue amphibole (crocidolite) consisting mainly of $NaAlSi_2O_6$ (jadeite) $NaAlSiO_4$, from Wisconsin. Named after James Gates Percival 5–1856), at one time State Geologist of Wisconsin.

erthitoid. P. Quensel, 1939. Geol. För. Förh. Stockholm, vol. 60 1938), p. 626. A perthitic texture shown by non-felspathic minerals, symplektic intergrowths of chondrodite-calcite, epidote-quartz, oclase-hornblende. Myrmeki-perthitoid when one of the com- nts is vermicular. [M.A. **7**–335.]

osphor-rösslerite. O. M. Friedrich and J. Robitsch, 1939. r. Min., Abt. A, 1939, p. 142 (Phosphorrößlerit), p. 143 (Phosphor- erit). Hydrous acid magnesium phosphate, $MgHPO_4.7H_2O$, as oclinic crystals isomorphous with rösslerite ($MgHAsO_4.7H_2O$). Salzburg. *See* Arsen-rösslerite. [M.A. **7**–316, 495.]

roamosite. D. P. Serdyuchenko, 1936. Bull. Acad. Sci. URSS, ci. Math. Nat., Sér. Géol., 1936, p. 689 (пикроамозит), p. 695 oamosite). A fibrous orthorhombic amphibole analogous to te (8th List; M.A. **4**–92), with MgO (29·26 %) in place of FeO; Caucasus. Named from πικρός, bitter, and amosite. [M.A. **7**–9.]

roknebelite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido .., Ser. 4, vol. 4, p. 404 (Picroknebelite). A variety of knebelite aining MgO 4 %. [M.A. **7**–412.] W. F. Foshag, Amer. Min., 1939, 24, p. 659, gives this as 'Picrotephroite'.

ly-irvingite. P. Quensel, 1937. Geol. För. Förh. Stockholm, 59, p. 467 (poly-irvingite). A lithia-mica much richer in silica than gite [4th List], occurring as an alteration product of amblygonite in len. [M.A. **7**–108.]

otash-analcime. E. S. Larsen and B. F. Buie, 1938. Amer. Min., 23, p. 837 (potash analcime). A potash-rich (K_2O 4·48 %) variety alcime in analcime-basalt from Montana. [M.A. **7**–448.]

oglauconite. I. Y. Mikei, 1936. V. I. Vernadsky jubilee volume, .. Sci. USSR, vol. 2, pp. 818, 825 (проглауконит), p. 826 (Proglau-). A hypothetical molecule, an alumoferrisilicate $R_2O_3.4SiO_2$, ing the basis of glauconite. [M.A. **7**–162.]

Promontmorillonite. I. D. Sedletzky, 1937. Compt. Ren (Doklady) Acad. Sci. URSS, vol. 17, p. 375 (Promontmorillonit); ibi 1940, vol. 26, p. 241 (Promontmorillonite). An artificial preparati with the chemical composition of montmorillonite, but amorpho (showing no X-ray pattern). On long standing it passes into typi montmorillonite.

Protocalcite. E. Balogh, 1937. Erdélyi Múzeum, Kolozsvár, 19 vol. 42, p. 147 (Protokálcit, Protocalcit). A mould-like encrustation calcium carbonate in a limestone cavern, consisting of fine needles wi oblique optical extinction. Evidently identical with lublinite (5th a 6th Lists). [M.A. **7**–515.]

Pseudo-succinite. J. D. Buddhue, 1938. Mineralogist, Portlan Oregon, vol. 6, no. 1, p. 21. Amber from Equilleres, Basses-Alp France, differing from Baltic amber in its reaction to solvents. [M. **7**–265.]

Pseudo-zircon. B. W. Anderson and C. J. Payne, 1937. Gemm logist, London, vol. 7, p. 298. Zircons of low specific gravity (3·95–4·0 which consist of amorphous SiO_2 and ZrO_2, and increase in densi when heated. *See* Meta-zircon and Zirconoid.

Pyroxenoid. H. Berman, 1937. Amer. Min., vol. 22, pp. 360, 3 (Pyroxenoid family). Group name for minerals of the rhodonite a wollastonite series, as distinct from the pyroxene group.

Retinosite. J. A. Dulhunty, 1939. Journ. Roy. Soc. New Sou Wales, vol. 72, p. 184. *See* Gelosite.

Rhenanite. H. H. Franck, M. A. Bredig, and R. Frank, 19 Zeits. Anorg. Chem., vol. 230, p. 2 (Rhenaniaphosphat, Rhenanit). artificial fertilizer prepared by the Rhenania process, said to have composition near $Ca_4Na_6(PO_4)_4CO_3$, but shown by R. Klement a P. Dihn (ibid., 1938, vol. 240, p. 40) to be a mixture of $CaNaPO_4$ a Na_2CO_3. Potassium-rhenanite, Kalium-Rhenanit (H. H. Franck, M. Bredig, and E. Kanert, ibid., 1938, vol. 237, p. 49) is the correspon ing compound $CaKPO_4$. Named from Latin, *Rhenus*, *Rhenanus* Rhine, Rhenish. [M.A. **7**–553.]

Rhodanite. G. Vavrinecz, 1939. Földtani Közlöny, Budape vol. 69, pp. 82, 98 (Rhodanit). Sulphocyanic (rhodanic) acid, HCN as a natural gas. Named from *ῥόδον*, rose. [M.A. **7**–471.]

ussellite. M. H. Hey and F. A. Bannister, 1938. Min. Mag., vol. 25, 1. Yellow pellets approximating in composition to $Bi_2O_3.WO_3$. y examination suggests that it is a mixed (tetragonal) crystal of $_3$ and WO_3, rather than a bismuth tungstate. Occurs as an altera- product with native bismuth and wolframite in Cornwall. Named Mr. Arthur Edward Ian Montagu Russell (1878–), of Swallowfield , Berkshire.

ustite. J. D. Buddhue, 1939. *See* Ayasite.

uthenosmiridium. S. Aoyama, 1936. Sci. Rep. Tôhoku Univ., 1, K. Honda anniv. vol., p. 527. A variety of iridosmine containing enium (Ru 21·08 %); hexagonal, RuOsIr. From Japan. [M.A. 5.]

akiite. N. S. Kurnakov and B. L. Ronkin, 1931. [Priroda, Acad. USSR, 1931, no. 7, p. 619.] O. M. Shubnikova, Trans. Lomonosov . Acad. Sci. USSR, 1936, no. 7, p. 333 (Сакиит, Sakiite). Synonym xahydrite, $MgSO_4.6H_2O$, from the Saki salt lakes, Crimea. Named the locality. [M.A. 4–378.]

aleeite. A. Schoep, Meded. Kl. Wetens. Kon. Vlaamsche Acad. ens. Lett., 1939, p. 65 (saléeiet), p. 70 (saléeite). The correct form leite (13th List), named after Prof. Achille Salée, of Louvain, ium.

alesite. C. Palache and O. W. Jarrell, 1939. Amer. Min., vol. 24, 88. Copper iodate, $CuIO_3(OH)$, as bluish-green orthorhombic als from Chile. Named after Mr. Reno H. Sales, chief geologist of Anaconda Copper Mining Company. [M.A. 7–369.]

apperite. R. Potonié, 1924. Kohlenpetrographie, Berlin, 1924, 20 (Sapperit). H. Meixner, Zentr. Min., Abt. A, 1938, p. 208; schr. Min. Krist. Petr., 1939, vol. 23, p. xlvi. Pure white cellulose rring in brown coal of Miocene age from Saxony, and in fossil wood asalt-tuff from Styria. Named after mining director — Sapper, of twitz, Saxony. [M.A. 7–170.]

arospatakite. I. D. Sedletzky, 1940. Compt. Rend. (Doklady) l. Sci. URSS, vol. 26, p. 242 (sarospatakite). The 'Glimmer von spatak' of E. Maegdefrau and U. Hofmann (Zeits. Krist., 1937, 98, p. 33), a micaceous clay from Sarospatak, Hungary. Named the locality.

Seyrigite. A. Lacroix, 1940. Compt. Rend. Acad. Sci. Paris, vol. 2 p. 276 (seyrigite). Tungstate and molybdate of calcium (MoO_3 24 intermediate between scheelite and powellite. Named after Mr. Seyr manager of the phlogopite mine in Madagascar where the mineral w found. [M.A. **7**–469.]

Sharpite. J. Mélon, 1938. Bull. Séan. Inst. Roy. Colon. Bel vol. 9, p. 333. Hydrated carbonate of uranyl, $6UO_3.5CO_2.8H_2O$, yellowish-green fibrous crusts, perhaps orthorhombic, from Shinkolob Katanga. Named after Major R. R. Sharp, who discovered the uraniu deposit at Shinkolobwe. [M.A. **7**–225.]

Shortite. J. J. Fahey, 1939. Amer. Min., vol. 24, p. 515. Dou carbonate of sodium and calcium, $Na_2CO_3.2CaCO_3$, as hemimorp orthorhombic crystals from Wyoming. Named after Prof. Maxw Naylor Short (1889–), of the University of Arizona. [M.A. **7**–370.]

Sialite. N. E. Efremov, 1939. Compt. Rend. (Doklady) Acad. S URSS, vol. 22, p. 434 (sialites). A collective name for hydrous a minium (Al) silicates (Si) or clay minerals. Later changed to Hyd sialite (q.v.). Compare Siallite (11th List). [M.A. **7**–370.]

Silico-apatite. I. D. Borneman-Starynkevich, 1938. Compt. Re (Doklady) Acad. Sci. URSS, vol. 19, p. 225 (Silico-apatite). A hy thetical molecule $Ca_5Si_3O_9(OH)_4$ substituting $Ca_5P_3O_{12}F_4$ in apat (SiO_2 5·95 %) from Shishim mines, Ural. [M.A. **7**–352.]

Simpsonite. H. Bowley, 1938. Rep. Dept. Mines Western Austral for 1937, pp. 93, 88; Journ. Roy. Soc. Western Australia, 1939, vol. (for 1938–39), p. 89; L. E. R. Taylor, ibid., p. 93. Hydrous tantalate aluminium and calcium, $CaO.5Al_2O_3.4Ta_2O_5.2H_2O$, hexagonal, fr Western Australia. Named after Dr. Edward Sydney Simpson (187 1939), Government Mineralogist and Analyst of Western Austral [M.A. **7**–369.]

The name simpsonite has also been applied to an alkalic amphib (A. Wade and R. T. Prider, Rep. Brit. Assoc. Adv. Sci., Cambrid 1938, p. 419. R. T. Prider, Abstr. Diss. Univ. Cambridge, 1939, 1937–38, p. 93; Min. Mag., 1939, vol. 25, p. 378) which was afterwa renamed magnophorite (q.v.).

Soda-alunite. J. D. Laudermilk, 1935. Amer. Min., vol. 20, p. (Soda-alunite). Alunite containing 4·62 % Na_2O from Hawaii. Synon of Natroalunite (3rd List). [M.A. **6**–188.]

oda-killinite. P. Quensel, 1938. Geol. För. Förh. Stockholm, 60, pp. 205, 215 (soda-killinite). An alteration product of spodu-, similar to killinite but rich in soda, and apparently consisting of a ure of soda-spodumene (q.v.), cimolite, halloysite, and illite (q.v.). . 7–120.]

oda-purpurite. P. Quensel, 1937. Geol. För. Förh. Stockholm, 59, p. 96 (Na-purpurite); ibid., 1939, vol. 61, p. 69 (soda-purpurite). nd-product, $(Mn,Fe)PO_4$, of alteration of the soda mineral varulite . List); as distinct from purpurite, $(Mn,Fe)PO_4$, an alteration uct of the lithium mineral lithiophilite. Similarly, Na-heterosite eterosite, both also $(Mn,Fe)PO_4$, alteration products of headdenite List) and triphylite. [M.A. 7–120.]

oda-spodumene. P. Quensel, 1938. Geol. För. Förh. Stockholm, 60, p. 214 (Na-spodumene). A presumed base-exchange product of mene with Na in place of Li, as distinct from the mixture β-mene of Brush and Dana, 1880. Not the Natron-Spodumen of Berzelius, 1824, = soda-spodumene (J. D. Dana, 1844) = oligo-. [M.A. 7–120.]

tibiomicrolite. P. Quensel and T. Berggren, 1938. Geol. För. Stockholm, vol. 60, p. 216 (Stibiomicrolite). O. Rosén and estgren, ibid., p. 226 (Stibio-Microlite). An unknown mineral with ssumed composition $(Sb,Ca)(Ta,Nb)(O,OH)_4$, which by alteration iven rise to a mixture of stibiotantalite and microlite, together with antimony and senarmontite. [M.A. 7–120.]

tiepelmannite. P. Ramdohr and E. Thilo, 1940. Zentr. Min., A, 1940, p. 1 (Stiepelmannit). Basic phosphate of yttrium, bium, and aluminium, $(Yt,Yb)PO_4.AlPO_4.2Al(OH)_3$, as rhombo-al crystals isomorphous with the cerium mineral florencite. Named Mr. — Stiepelmann, owner of the gem mine in South-West Africa e the mineral was found. [M.A. 7–514.]

trontium-apatite. A. N. Winchell, 1927. Elements of optical ralogy, 2nd edit., pt. 2, p. 128 (Strontiumapatite). Synonym of orite (5th List).

ulfurosite. G. Vavrinecz, 1939. Földtani Közlöny, Budapest, 69, pp. 82, 98 (Sulfurosit). Sulphur dioxide, SO_2, as a natural gas. . 7–471.]

Tantalopolycrase. E. S. Simpson, 1938. Journ. Roy. Soc. Australia, vol. 24, p. 112; Rep. Dept. Mines, W. Australia, for 19 p. 88. Titano-tantalate of yttrium, $YtTi_2TaO_8$, differing from po crase in containing tantalum in place of niobium. From West Australia. Previously included under tanteuxenite [$YtTi_2TaO$ $Yt_2Ta_2O_8$(+$CaTiTa_2O_8$, &c.)] (12th List).

Tchinglusuite. V. I. Gerasimovsky, 1938. *See* Chinglusuite.

Teepleite. W. A. Gale, W. F. Foshag, and M. Vonsen, 1939. Am Min., vol. 24, p. 48. (Earlier mentioned in Amer. Min., 1938, vol. p. 90; and A. Pabst, Minerals of California, 1938, p. 167.) Hydra borate and chloride of sodium, $Na_2B_2O_4.2NaCl.4H_2O$, as tetrago crystals from the dried-up Borax Lake, California. Named after the l Dr. John E. Teeple, who described the artificial salt in 1929. [M 7–263.]

Teineite. T. Yosimura, 1939. Journ. Fac. Sci. Hokkaido Un Ser. 4, vol. 4, p. 465. Hydrous tellurate and sulphate of copp $Cu(Te,S)O_4.2H_2O$, as blue orthorhombic crystals from Teine mi Japan. Named from the locality. [M.A. 7–316.]

Thanite. G. Vavrinecz, 1939. Földtani Közlöny, Budapest, vol. pp. 82, 98 (Thanit). Carbon oxysulphide, COS, as a natural g Named after Karl Than, who discovered it in 1867. [M.A. 7–471.]

Tirodite. J. A. Dunn and P. C. Roy, 1938. Rec. Geol. Surv. Ind vol. 73, p. 295 (tirodite). A manganese amphibole (MnO 8·25 differing from dannemorite and richterite, from Tirodi, Central P vinces, India. Named from the locality. [M.A. 7–317.]

Titano-spinel. J. de Lapparent, 1937. Min. Petr. Mitt. (Tscherma vol. 49, p. 15 (titano-spinelle). Spinel in the emery of Samos assumed contain titanium, but not analysed. [M.A. 7–150.]

Torniellite. E. Dittler and F. Kirnbauer, 1937. Zeits. Pra Geol., vol. 45, p. 120 (Torniellit). An amorphous clay mine $Al_2Si_2O_5(OH)_4.H_2O$, near to halloysite. Named from the local Torniella, Toscana. [M.A. 7–12.]

Uran-galena. O. M. Shubnikova, Trans. Lomonosov Inst. Acad. USSR, 1937, no. 10, p. 171 (Урановый галенит, Uran-galena). Vari of U-galena (14th List).

atchite. G. Switzer, 1938. Amer. Min., vol. 23, p. 409; J. Murdoch, 1938, vol. 23, no. 12, pt. 2, p. 11. Hydrous borate of calcium, $_6O_{11}.2H_2O$, monoclinic, occurring in cross-fibre veins; from Cali-a. Named after Dr. John A. Veatch, who first detected borates in rnia in 1856. [M.A. **7**–169, 263.]

rdelite. P. Quensel and O. Gabrielson, 1939. Geol. För. Förh. holm, vol. 61, p. 67. Green tourmaline, completing the series of r varieties—achroite, rubellite, and indicolite. From *verd* (Old h), *verde* (Italian), and *λίθος*. [M.A. **7**–336.]

adeite. A. Wade and R. T. Prider, 1938. Rep. Brit. Assoc. Adv. Cambridge, 1938), 1938, p. 419. R. T. Prider, Abstr. Diss. Univ. ridge, 1939, for 1937–38, p. 93; Min. Mag., 1939, vol. 25, pp. 373, Silicate of potassium, zirconium, &c., approximately $K_2CaZrSi_4O_{12}$, xagonal plates from Western Australia. Named after Dr. Arthur . who collected the material.

berite. R. Bøgvad, 1938. Meddel. om Grønland, vol. 119, no. 7 erite). Fluoride of sodium, magnesium, and aluminium, Na_2MgAlF_7, le grey monoclinic grains in cryolite from Greenland. Named after bald Weber, who in 1857 founded the Øresund cryolite works. **7**–225.]

odhouseite. D. M. Lemmon, 1937. Amer. Min., vol. 22, p. 939. ated sulphate and phosphate of calcium and aluminium, $2CaO._5.P_2O_5.2SO_3.6H_2O$, as small colourless rhombohedral crystals from rnia. Named after Mr. C. D. Woodhouse, of Santa Barbara, rnia. [M.A. **7**–13.]

magaguchilite. S. Hata, Sci. Papers Inst. Phys. Chem. Research, o, 1938, vol. 34, p. 622. Another spelling of yamagutilite (14th . [M.A. **7**–263, 264.]

atmanite. C. Palache, L. H. Bauer, and H. Berman, 1937. Amer. vol. 22, no. 12, pt. 2, p. 11 (abstract); ibid., 1938, vol. 23, pp. 176, Silico-antimonate of manganese and zinc, $(Mn,Zn)_{16}Sb_2Si_4O_{29}$, as n triclinic crystals from Franklin Furnace, New Jersey. Named Mr. Pope Yeatman, mining engineer at Franklin Furnace. [M.A. , 168.]

tro-columbo-tantalite. C. Lepierre, 1937. Mem. Acad. Ciên. a, Cl. Ciên., vol. 1, p. 374 (Ytro-Columbo-Tantalite), p. 369 ocolumbite). A variety of yttrotantalite with niobium in excess of

tantalum, from Mozambique. The name yttrocolumbite appears in t index to Dana's 'System' (1892) but not in the text. [M.A. 7–470.]

Zinc-manganocalcite. G. Gagarin, 1936. Ann. Géol. Péninsule B kan., vol. 13, p. 74 (Zink-manganokalcit), p. 78 (Zinc-manganocalcit A variety of calcite containing MnO 3·71 % and ZnO 0·78 %, fr Serbia. [M.A. 7–256.]

Zinc-magnesia-chalcanthite. C. Milton and W. D. Johnst 1937. Amer. Min., vol. 22, no. 12, pt. 2, p. 10; 1938, vol. 23, p. 175

Zirconoid. E. E. Kostyleva, 1936. Trans. Lomonosov Inst., M Ser., Acad. Sci. USSR, no. 7, p. 223 (цирконоиды), p. 224 (zirconoid Zircons of low specific gravity and optically isotropic, consisting o mixture of ZrO_2 and SiO_2 in a metamict state. The name zirconoid already in use for the tetragonal form (*hkl*) [e.g. Dana's Textbook Mi [M.A. 7–130.]

SYSTEMATIC CLASSIFICATION OF NEW MINERALS[1]

Elements

Moschellandsbergite, Ag_2Hg_3.
Cuproauride, Cu_3Au_2.
Ruthenosmiridium, RuOsIr.

Sulphides, etc.

Uran-galena.
Brunckite, gel ZnS.
Pararammelsbergite, $NiAs_2$.
Gratonite, $9PbS.2As_2S_3$.
Falkmanite, $3PbS.Sb_2S_3$.
Cuproboulangerite.

Haloids

Antofagastite, $CuCl_2.2H_2O$.
Weberite, Na_2MgAlF_7.

Oxides

Alumo-berezovite, $(Fe,Mg)O.(Cr,Al)_2O_3$.
Alumo-chrompicotite, $(Mg,Fe)O.(Cr,Al)_2O_3$.
Titano-spinel.
Ilmeno-corundum.
Garividite, $3Mn_3O_4.2Fe_2O_3$.
Devadite, $5Mn_3O_4.5Mn_2O_3.8Fe_2O_3$.

Hydroxides

Hydrotenorite, $4CuO.H_2O$.
Cupro-asbolane.

Carbonates

Zinc-manganocalcite.
Shortite, $Na_2CO_3.2CaCO_3$.
Ferropyroaurite, $MgCO_3.2Fe(OH)_2.5Mg(OH)_2.4H$
Ferripyroaurite, $MgCO_3.2Fe(OH)_3.5Mg(OH)_2.4H$
Sharpite, $6UO_3.5CO_2.8H_2O$.

Sulphates, etc.

Ferroepsomite.
Kirovite, $(Fe,Mg)SO_4.7H_2O$.
Jarošite, $(Fe,Mg)SO_4.7H_2O$.
Cuprokirovite, $(Fe,Cu,Mg)SO_4.7H_2O$.
Cuprojarošite, $(Fe,Cu,Mg)SO_4.7H_2O$.
Leightonite, $K_2Ca_2Cu(SO_4)_4.2H_2O$.
Metahohmannite, $Fe_2(SO_4)_2(OH)_2.3H$
Metasideronatrite, $Na_4Fe_2(SO_4)_4(OH)_2.3H$
Parabutlerite, $FeSO_4(OH).2H_2O$.
Teineite, $Cu(Te,S)O_4.2H_2O$.

Chromates, Tungstates

Lopezite, $K_2Cr_2O_7$.
Seyrigite, $Ca(W,Mo)O_4$.
Russellite, $Bi_2O_3.WO_3$.

[1] Only selected names given in the preceding alphabetical list are here includ

Iodate

…te, $CuIO_3(OH)$.

Borates

…te, $Mg_3B_2O_6$.
…hite, $Ca_2B_6O_{11}.2H_2O$.
…te, $Mg_2B_6O_{11}.15H_2O$.
…lite, $CuB_2O_4.CuCl_2.4H_2O$.
…dite, $Ca_3(B_6O_{11})_3Cl_4.4H_2O$.
…ilgardite, $Ca_3(B_6O_{11})_3Cl_4.4H_2O$.
…ite, $Na_2B_2O_4.2NaCl.4H_2O$.

Phosphates, etc.

…-apatite.
…ium-apatite.
…apatite.
…adite, $Ca_{10}(P,S,Si)_6O_{24}(Cl,F,OH)_2$.
…malite, $CaYt_2(Si,P)_2O_8$.
…anvoelckerite,
$3(Ca,Mn)_3(PO_4)_2.(Ca,Mn)(O,F_2)$.
…purpurite, $(Mn,Fe)PO_4$.
…asite, $3(Mn,Fe,Ca)_3(PO_4)_2.2NaOH$.
…-lmannite,
$(Yt,Yb)PO_4.AlPO_4.2Al(OH)_3$.
…kite, $FePO_4.2Fe(OH)_3.3H_2O$.
…, $Ca_3Al_8(PO_4)_8(OH)_6.15H_2O$.
…omeryite,
$Ca_4Al_5(PO_4)_6(OH)_5.11H_2O$.
…louseite,
$2CaO.3Al_2O_3.P_2O_5.2SO_3.6H_2O$.
…hor-rösslerite, $MgHPO_4.7H_2O$.
…-rösslerite, $MgHAsO_4.7H_2O$.

Niobates, etc.

…ipolycrasite.
…-columbo-tantalite.
…microlite, $(Sb,Ca)(Ta,Nb)(O,OH)_4$.
…sonite, $CaO.5Al_2O_3.4Ta_2O_5.2H_2O$.

Silicates

…m-albite.
…nstatite, $MgSiO_3$.
…alc, $MgSiO_3$.
…otite, Al-hypersthene.
…ne-acmite.
…odumene.
…spodumene.
…um-spodumene.
…ite, $H_2Ca_2Mg_4AlFe'''Si_6O_{26}$.
Picroamosite.
Ferrigedrite.
Ferrogedrite.
Fluor-tremolite.
Mangan-actinolite.
Tirodite, Mn-amphibole.
Magnesio-cummingtonite.
Magnophorite, K-Mg-katophorite.
Nickel-olivine.
Ferrohortonolite.
Iron-tephroite.
Mangan-knebelite.
Ferribiotite.
Ferriwotanite.
Lithium-muscovite.
Poly-irvingite, var. Li-mica.
Wadeite, $K_2CaZrSi_4O_{12}$.
Chkalovite, $Na_2Be(SiO_3)_2$.
Yeatmanite, $(Mn,Zn)_{16}Sb_2Si_4O_{29}$.
Lovozerite, $R_2O.RO.ZrO_2.6SiO_2.3H_2O$.
Aminoffite, $Ca_8Be_3AlSi_8O_{28}(OH).4H_2O$.
Armenite, $BaCa_2Al_6Si_9O_{28}.2H_2O$.
Chinglusuite,
$2(Na,K)_2O.5(Mn,Ca)O.3(Ti,Zr)O_2.$
$14SiO_2.9H_2O$.
Cuprorivaite, hyd.sil.Cu,Ca,Al,Na.
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Paradeweylite, $4MgO.3SiO_2.3H_2O$.
Gedroitzite, $Na_2O.Al_2O_3.3SiO_2.2H_2O$.
Foshallassite, $3CaO.2SiO_2.3H_2O$.
Potash-analcime.

Hydrocarbons

Gelosite.
Humosite.
Kansasite.
Kratochvilite.
Magallanite.
Matrosite.
Pseudo-succinite.
Retinosite.
Sapperite.

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This index supplements those previously given for Lists 1–5 (Min. Mag. 19 vol. 15, p. 436) and Lists 6–10 (Min. Mag. 1925, vol. 20, p. 471), and so brings up date the very useful index given in A. H. Chester's 'A dictionary of the names minerals' (New York and London, 1896).

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